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UNITED STATES DEPARTMENT OF AGRICULTURE

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Washington, D. C. ▼ June 20, 1923

# SILVER-FOX FARMING

By

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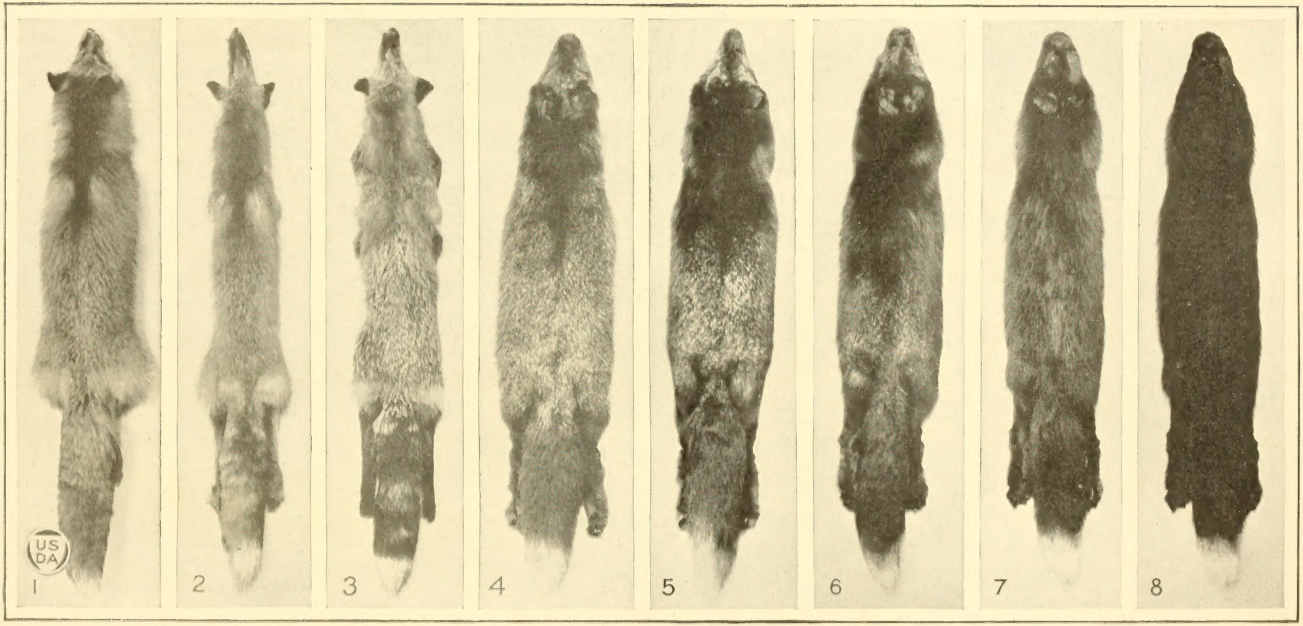


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COLOR PHASES OF THE RED FOX (GENUS VULPES).

1. Red fox; 2 and 3, cross foxes; 4, pale silver (75 per cent silver); 5, silver (50 per cent silver); 6, dark silver (25 per cent silver); 7, extra dark silver (10 per cent silver); 8, black fox (no silver). The tip of the tail is white in all phases.

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By Frank G. Ashbrook,

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## INTRODUCTION.

Silver-fox farming has attracted wide attention, chiefly because of the enormous profits derived from the sale of pelts and breeding stock. As a fur animal propagated in captivity the silver fox has no rival, and both live foxes and their pelts are in demand. Probably no other live-stock enterprise pays larger returns for the money invested, although erroneous statements regarding this industry have been made that have misled the public as to its real status. In a majority of instances lack of authentic information concerning the feeding, breeding, and management of silver foxes has led to misstatements, although many people have been misled purposely by unscrupulous ranchers and organized companies. That such ranchers and companies would use the silver fox as a medium to extract money from persons unfamiliar with the business was only to have been expected, as such a condition is found in every enterprise; and

[1] In preparing the section on breeding the writer was assisted by E. W. Sheets, Acting Chief, and Dr. Sewall Wright, of the Division of Animal Husbandry, Bureau of Animal Industry; and by Dr. G. M. Rommel, formerly chief of that division. In preparing the section on diseases and parasites he was assisted by Dr. M. C. Hall, of the Bureau of Animal Industry; and by Dr. K. B. Hanson and Dr. H. L. VanVolkenberg, of the Bureau of Biological Survey.

Note.—This bulletin supersedes Farmers' Bulletin 795, The Domesticated Silver Fox.

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it has been quite common in the silver-fox industry, chiefly because the business is new and profitable.

The production of silver foxes has proved to be most profitable when conscientiously and intelligently managed. A silver-fox pelt of high quality, taken in the wild, has always been and still is a very rare article. A number of raw-fur buyers claim that pelts produced on ranches are not popular with the fur trade because they are unprime and lack the quality and finish of wild fur. That this is untrue is shown by the fact that approximately 90 per cent of the silver-fox pelts sold on the fur market to-day are from ranch-bred foxes. During February, 1922, 2,375 silver-fox pelts from ranches all over the United States and Canada were sold in London, and the pelt which brought the top price of the market, $631.68, was from a ranch-raised fox from the United States.

Raising silver foxes in captivity, unlike other live-stock enterprises, is an industry of too recent development to be supported by extensive study and research. It is possible, however, to assist beginners, as well as established ranchers, with information on some of the various phases of the business, such as organizing the ranch, feeding, breeding, management, pelting, sanitation, and the control of diseases and parasites. Information in the following pages is based on a study of methods and practices which have been found to give the greatest satisfaction on ranches in the United States and Canada, supplemented by observations and investigations on the Biological Survey's experimental fur farm at Keeseville, N. Y.

For other foxes raised on farms, such as the red, cross, and blue foxes, the general principles of ranch construction and management here set forth will be found applicable generally.

## WHAT IS A SILVER FOX?

The name silver fox, as commonly used by furriers, includes the dark phases of the ordinary red fox, variously called silver, silver-gray, silver-black, or black (Pl. I). The color of the red fox of the Northeastern States and of its allies of the colder parts of North America varies from red to black, and these extremes, with the gradations between them, form four more or less distinct phases, known, respectively, as red, cross or patch, silver, and black.

The silver fox, therefore, is a color phase of the red fox. It is dark all over, with silver hairs intermixed, but no red, and the tip of the tail is generally, but not always, white. The guard hairs which give the silver appearance to the pelage are not entirely white, but are black with a white band, and some guard hairs are entirely black. Variation in guard hairs is shown in Figure 1.

In the red phase the coat is entirely rich fulvous; that is, tawny or dull yellow with a mixture of gray and brown, excepting restricted black markings on the feet and ears, a white area at the end of the tail, and certain white-banded hairs on the back and rump. From this phase to the next the black increases in extent until in the typical cross fox the black predominates on the feet, legs, and underparts, while fulvous overlying black covers most of the head, shoulders, and back. A gradual increase of the black and elimination of the fulvous or its replacement by white brings the next phase, the silver fox, in which no fulvous appears, the entire

pelage being dark at the base and heavily or lightly overlaid with the banded guard hairs previously described. Silver foxes vary from almost entirely silver to those which are entirely black except for a few white-banded guard hairs on the back and rump. Finally, in the black fox the white is absent from all parts except the tip of the tail, which, as in all phases, is usually white.

In general, the cross fox is fairly common, the silver very scarce, and the pure black exceedingly rare. The prices usually paid for the different skins vary according to the relative scarcity of the animals and the market demand. Red-fox skins command only a moderate price; cross foxes bring somewhat more; and silver foxes several times as much. Black foxes are not so popular at present, for the reason that dyers can so closely imitate them with a dyed red fox that the average person can not tell the natural black fox from a dyed skin.

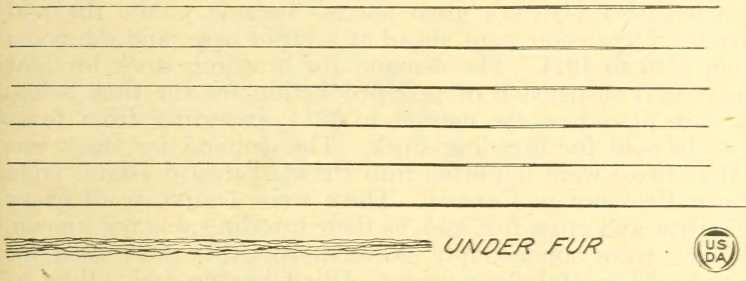


FIG. 1.—White bands on guard hairs of the silver fox. The extent of the band and distance from the end is indicated, as well as the relative lengths of the guard hairs and the under fur.

## HISTORY OF FOX FARMING.

The early history of fox farming is fraught with frenzied finance, breeding stock selling as high as $34,000 a pair and individual pelts at $2,700. It reads like a romance. The operations of the breeders were cloaked with secrecy, and the public was first skeptical, then gullible.

Before the industry started silver foxes were caught occasionally by trappers in the far North and their furs shipped to London, where, because of their rarity and attractiveness, they brought exceptionally high prices—in fact, more than any other furs on the market.

Realizing the scarcity of silver foxes and the possibility of their extermination, Charles Dalton, a trapper and fur trader of Prince Edward Island, began in 1887 to experiment with the breeding of red foxes, with the thought that he might be able to obtain crosses or silvers through "throwbacks." About this time he heard of a trapper in the Province who had two pairs of silver foxes in captivity, and, purchasing these animals, he abandoned the raising of the red foxes. Building a special farm at his home in Tignish, he installed his purchases and devoted his entire time to his study. Meantime, unknown to Dalton, a like experiment was being carried on by Robert Oulton, who was more fortunate, in that he obtained specimens of silver foxes at the start and devoted his time to these. When Dalton heard of the new experiment he paid Oulton a visit,

and the meeting of these men resulted in the formation of a partnership. Their first wire pen was built on Savage Island, where Oulton owned a ranch. Dalton had definite ideas concerning the problems involved and the most promising lines to follow in developing the industry, but Oulton, the practical farmer and stockman, made success possible because of his experience and natural ability in handling live stock.

In the course of a few years stories concerning the wealth to be obtained from the silver-fox business leaked out, and as the results of these first experiments became known a fox-farming boom started. Three sisters cleared $25,000 a year out of their venture. A small party of clerks organized a company and made $40,000 in four years. A pup was sold for $9,000. A consignment of 25 choice skins sent to London brought $34,175, an average of $1,367 per skin, the top prices for the choicest pelts being $2,700, $2,650, and $2,500.

Prior to 1910 people were working to establish an industry, but when knowledge of Dalton's great success became public the real boom started. Expansion went ahead at a rapid pace, and the boom lasted from 1910 to 1914. The demand for breeding stock brought about the virtual suspension of pelt production for the time being. No skins were placed on the market in 1911, excepting from foxes too poor to be sold for breeding stock. The demand for stock was so great that foxes were imported into Prince Edward Island from nearly every Province in Canada. These were a mixture of every variety of silver and cross fox, and, as their breeding was not known, their offspring were nondescript. Nevertheless, they were used for breeders and sold for fabulous prices. Illicit buying and selling of foreign stock misrepresented by producers engaged in this practice was very harmful to the industry, and the brown color now cropping out on many ranches among supposedly pure silvers is undoubtedly due to foxes of unknown breeding.

During the boom period ranches were started in New England and in New York and the industry rapidly spread to other parts of the country.

With the beginning of the World War in 1914 and the general conditions resulting from the war the boom was killed and more serious thinking began among the breeders engaged in the industry. With the depression of the fur market in England in 1915 and the sudden development of the fur trade in the United States, Canadian ranchers [2] turned to this country for the marketing of their pelts. The rapid rise and fall of the fur market caused ranchers to take a different view of the business, and it has now come to be realized that pelt value is the only safe basis on which to establish the industry.

## FOX-GROWING AREAS OF NORTH AMERICA.

The natural habitat of the silver fox includes the greater part of northern North America from the central United States northward to and including the border of the treeless tundras. (Fig. 2.) The red fox inhabits nearly all of this region, but animals of the silver phase, although found in most parts of it, are very irregularly dis-

[2] The terms "rancher," "caretaker," "attendant," "breeder," and "feeder" as used in this bulletin refer to one and the same person.

tributed. In general, the silver fox is more common in northern localities than in southern. To-day it is an exceedingly rare occurrence for one to be trapped in the wild, although they have been

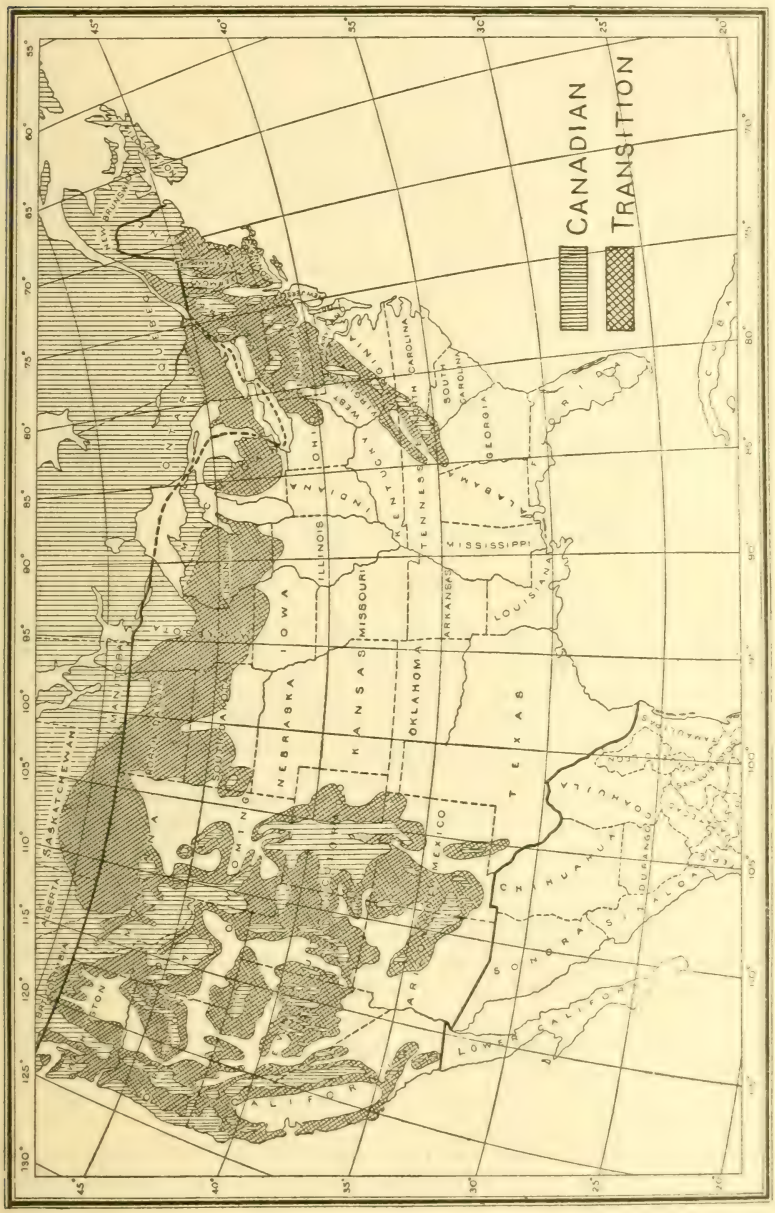


Fig. 2.—Map of life zones in which fox farming is feasible in the United States, showing the Canadian Zone, where conditions are excellent, and the Transition Zone, in parts of which conditions are favorable. In cooler areas just south of these zones fox farming has also been successful.

taken in Newfoundland, in the height of land between Quebec and the peninsula of Labrador, and along the upper Yukon, in Yukon Territory, and in the eastern adjacent region of central Alaska.

Among fur buyers it is well known that the pelts produced in northern localities are the more valuable, and while their experience teaches that certain areas are not too far south to produce valuable furs, their conclusions are only general. The average person can not judge whether his own locality is suitable for fox farming, especially if the wild fur animals have been exterminated there. It is necessary, therefore, to ascertain definitely the areas within which foxes are known to produce superior fur.

In general it may be said that silver foxes are being grown successfully in practically every one of the northern tier of States from New England westward to Washington and Oregon, and in the cooler parts of California, Colorado, Kansas, Iowa, Missouri, Illinois, Indiana, Ohio, Pennsylvania, New Jersey, and Massachusetts.

Judging from figures that are as correct a representation as it is possible to obtain under existing conditions in the United States, it is estimated that in 1922 there were 500 ranchers raising silver foxes; that there were between 12,000 and 15,000 foxes in captivity; and that the value of the investment was about $8,000,000. This information is based on replies to an official questionnaire sent out annually to all known fur farmers in the United States. There may be isolated ranches in contiguous territory, but owing to their failure to reply to the questionnaire the Biological Survey has no record of them.

### RECOMMENDATIONS TO BEGINNERS IN THE INDUSTRY.

It is not wise for anyone unfamiliar with fox raising to start with a large number of animals. Many troubles and obstacles arise, the remedies for which can not yet be found in books, but must for the present be learned through experience. A number of people who started in this business on too large a scale, or who expanded too rapidly, have made a failure of it. The better method is to start with a few pairs of foxes and gradually increase the number as one's knowledge of care and management enlarges.

Quality, not quantity, is the factor that counts in breeding silver foxes. On a small ranch the character, disposition, and breeding of individual foxes can be studied intelligently, but this is difficult, if not impossible, on a large ranch.

Stock should generally be obtained during the fall in order that the animals may become thoroughly accustomed to their new surroundings before the breeding season. The weather is sufficiently cool by the end of September to permit the shipment of foxes with safety.

## SELECTING A RANCH SITE.

### CLIMATE AND SHADE.

The production of a fine quality of fur is closely related to climate. A long, cold winter with a fair amount of rainfall, particularly in spring, is conducive to the production of good fur. Hot summers are not detrimental if short and followed by a season of frosty weather, during which time the animals can renew their coats.

It has been stated that excessive sunshine causes fox pelts to fade. When the pelt of a fox is being shed the food supply to the fur is

cut off: hence it is a natural condition for the hairs to die and be shed, and sometimes dead hairs turn various shades of brown and chocolate. During the season when the fox's pelt is becoming prime there will sometimes be found a chocolate tinge, commonly known as rust. This, however, is not caused by sun bleaching, but is due rather to inferior breeding stock, which has a tendency to throw rust-colored pelts instead of pelts of clear black in the underfur and in that part of the guard hairs which is supposed to be raven black.

A happy medium of shade and sunshine is necessary for the comfort of the foxes as well as for the maintenance of their health. Every animal likes to lie in the shade during extremely hot weather to escape the direct rays of the sun. Sunshine, on the other hand, is the best natural disinfectant for keeping the dens, pens, and grounds clean and sanitary.

When the fox industry was in its infancy most fox raisers thought that dense shade on their ranches was absolutely necessary. At first this was produced mainly by evergreens; later, a mixture of evergreens and hardwoods was employed. Fox ranchers are now learning the advantages of sunlight in keeping the pens sanitary and are cutting out the evergreens and allowing only the hardwoods to stand. Pine needles are objectionable because they fall into the feed and are consumed by foxes; they sometimes injure the intestines of pups and cause their death. An advantage in favor of hardwood trees is the fact that in winter, after they have shed their leaves, they allow the sun to shine into the pens.

## SOIL.

Silver foxes can be successfully raised on any type of soil that is well drained and capable of producing reasonable shade, provided it is located in a section where there is a long, cold winter and a fair amount of rainfall.

Successful ranches are to be found on rich heavy soil, clay soil, light sandy soil, and on sandy soil where the main part of the surface consists of outcroppings of rock and gravel. Any one of these, if well drained, is adapted to fox ranching.

It has not been definitely determined that certain types of soil are more favorable than others to the propagation of fox parasites. Soils possessing an undue amount of moisture, however, and densely shaded situations are favorable to the development of parasites.

The elements contained in the soil have no bearing on the kind and quality of foxes produced. It has been stated that soil devoid of lime is more favorable because it does not burn the pelt when the fox burrows, but there is no foundation for this belief, as there is no evidence that soil which will support vegetation contains enough lime to burn fur.

## LOCATION OF THE RANCH.

The latitude and climate having been determined, the next important consideration is the proper location for the ranch. It is possible closely to approximate the conditions under which wild foxes live, but this is by no means essential. In fact, it is somewhat doubtful whether to-day this is even desirable.

Fox ranchers are now established in every conceivable place. Some are to be found many miles from civilization, tucked away in the woods, while others have established ranches in small towns or near the larger cities. Some are found in dense forests, in apple orchards, in wood lots (Fig. 3), in open fields, on gravelly slopes

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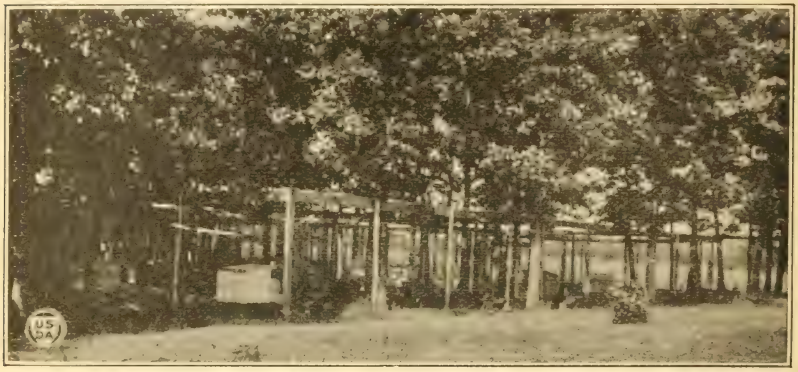

FIG. 3.—Fox ranch in woodlot about 100 yards off the main road.

(Fig. 4), on steep sloping hills (Fig. 5), on islands, and on sandy deserts. In any situation there are always ways of avoiding the disturbances which might be caused by too many visitors, by dogs, or by undue noises during the breeding and whelping periods.

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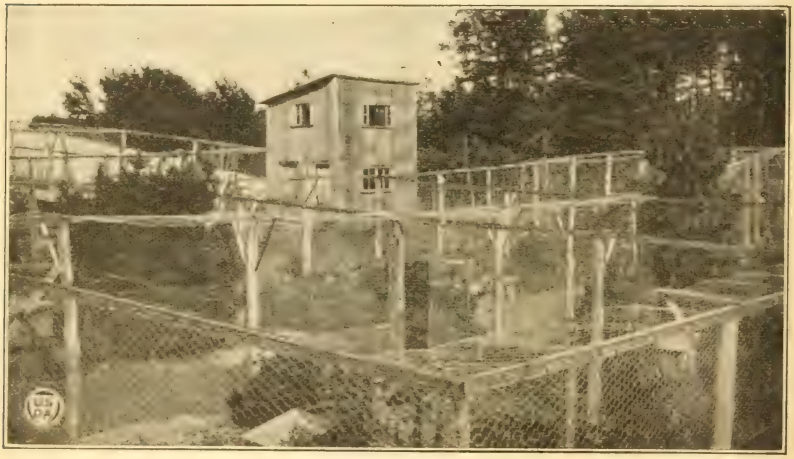

FIG. 4.—Fox ranch on a gravelly slope.

The ideal location probably is a reasonably level, well-drained piece of land with a gentle slope to the south. It is not intended to convey the impression that foxes should be ranched only on such land, for they are being raised successfully on rolling ground and on hillsides. The productiveness of the soil is of little direct im-

portance. If the area does not include a few trees, however, they should be planted to provide shade in summer and to encourage a feeling of seclusion and security in the animals. Construction will be facilitated if there is a hardpan subsoil, as the walls of the pen would not then need to extend below this to prevent the animals from burrowing under and escaping.

In exaggerated advertising or publicity matter the fox farm is usually described as occupying a lonely island or a vast inclosure of wild land, and too often beginners are led to believe that such places are essential. Islands have some advantages and apparently are suited to the requirements of the silver fox, but their inaccessibility makes it difficult to secure feed and supplies. While good roads facilitate the hauling of feed and supplies, they are of little importance in the matter of marketing the pelts, for foxes differ in this

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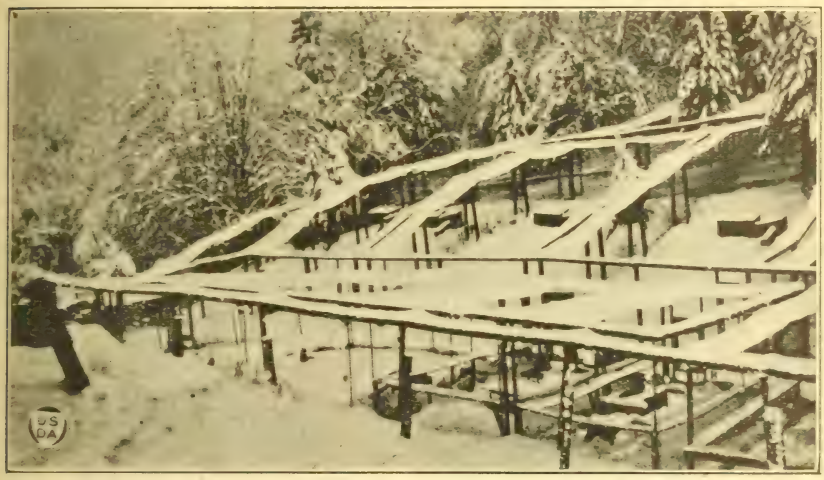

FIG. 5.—Fox ranch on a hillside.

respect from other classes of live stock. It is an advantage to locate in a fox-raising community, in order to profit by the experiences of others.

## RANCH ORGANIZATION.

### PLAN OF THE RANCH.

When the location of the land on which the ranch is to be constructed has been decided upon the area should be cleared of underbrush. This is desirable, no matter on what type of soil the pens are to be built. It is well, also, before the pens are staked out to remove all stumps and sticks in order to eliminate the danger of pups or older foxes running against or falling over such obstructions and thus injuring themselves. The branches of the trees should be trimmed from the trunks to a height above that of the fence line so that the foxes can not crawl up and jump over the fence. Trunk shields should be nailed to the tree trunks at a height of 10 feet from

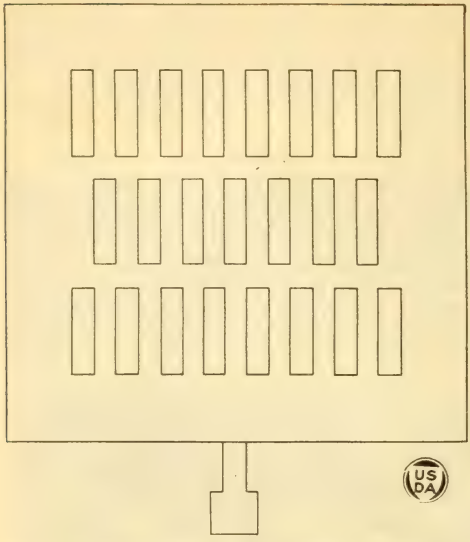

FIG. 6.—Square plan of ranch, showing location of watch tower and the alternate arrangement of pens to permit easy observation.

the ground. The shields can be made of wire or tin. Trimming branches from the trees 10 to 12 feet up the trunk will facilitate construction and also the free movement of air through the ranch, and the branches will not hamper the rancher in his daily work.

Ranches vary in size from 2 up to 100 or more pens in a single layout. It is advisable to have a space of 2 feet between the pens, for serious injuries will result if foxes are separated by only a single partition of wire netting. Foxes climbing the wire have had feet, legs, and tails torn off by the occupant of the neighboring pen. Such accidents can be avoided only if the walls are separated. Another advantage of such construction is that it will lessen the chances of disease spreading through an entire ranch.

The space between rows of pens should be at least 15 feet, in order to permit a horse and wagon to be driven through to haul necessary materials. The advantages derived from this arrangement more than offset the additional cost.

The idea of enlarging or adding to the ranch should be kept in mind when making the original layout. There are various methods of laying out pens, such as are shown in Figures 6, 7, and 8. When arranged as nearly as possible in the form of a square the expense of inclosing by a guard fence is less than when the pens are arranged in long rows. It is false economy to build too many pens on a small piece of land. Pens of ample size are those containing from 800 to 1,500 square feet.

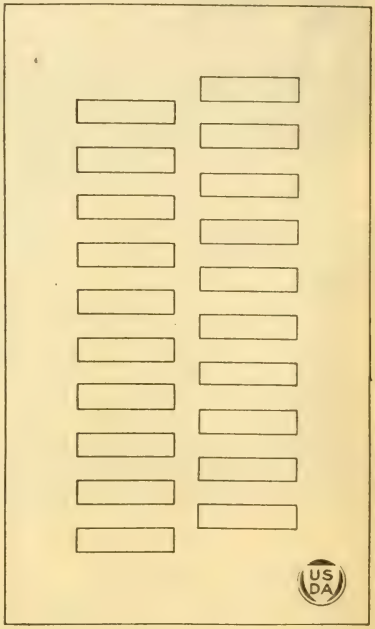

FIG. 7.—Rectangular plan of ranch.

## CONSTRUCTION OF PENS.

### SIZE AND SHAPE.

There are almost as many styles of pens as there are fox ranches. They range from very large ones to those so small as to endanger the health of the foxes, both in the matter of sanitation and through lack of space for exercise.

The usual procedure has been to construct a pen the inside area of which has been inclosed by one roll of wire of 150 linear feet.

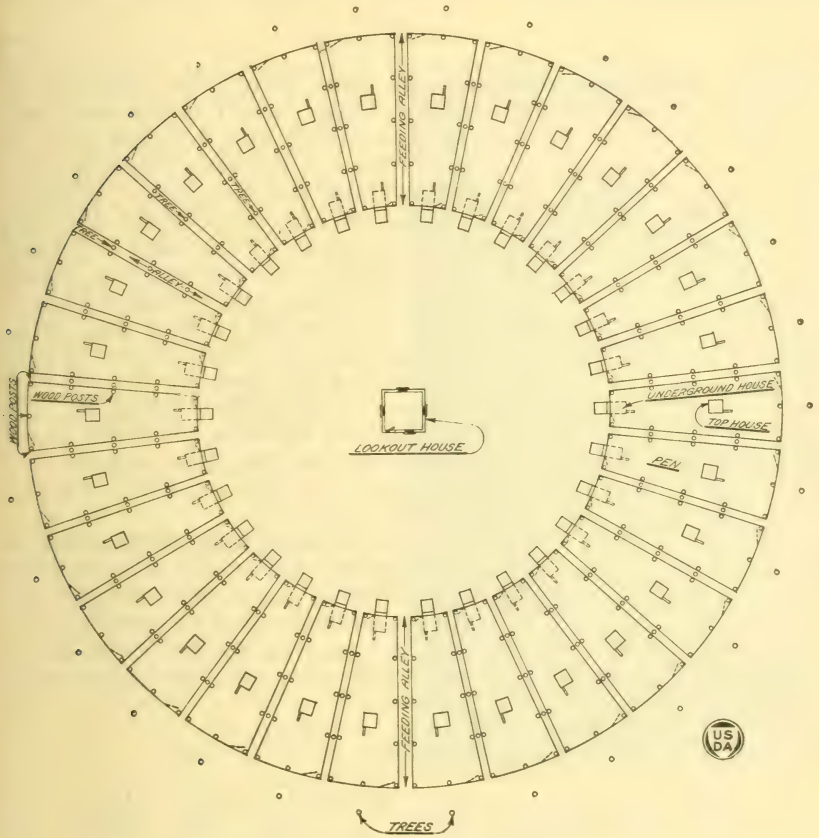


FIG. 8.—Circular plan of ranch.

This has been done primarily for convenience, as it obviates the necessity of cutting the rolls of wire and lacing the pieces together.

Conditions of topography may make it necessary to build pens long and narrow instead of square, but the number of square feet inclosed depends upon the shape of the pen. A 150-foot roll of wire will inclose an area 50 by 25 feet (1,250 square feet), or one 30 by 45 feet (1,350 square feet), or one 37 by 37 feet (1,369 square feet). The more nearly uniform are the lengths of the sides, or the more nearly a pen approaches a circle, the more square feet can be inclosed by a given length of wire. A circular pen, however, is very difficult

to construct. The nearest practicable approach to it is one having eight sides, a type now being used by some ranchers. The additional area inclosed in this type of pen is not its only advantage. The principal advantage lies in its widened corners, as this feature minimizes the danger that foxes will crawl up the wire.

Many ranchers have built pens 50 by 25 feet with a partition fence midway, making double pens 25 by 25. The advantage claimed for this is that the adults can be separated during the period of pregnancy and while the pups are very young. When the parents and young are kept together, the pups can be fed in one pen and the old foxes in the other.

### CHUTES.

Small chutes constructed between pens permit the foxes to be transferred from one to the other. These should be not less than 10 inches high and 9 inches wide to allow the fox to crawl through without rubbing the pelt and injuring or pulling out the guard hairs. It is not advisable to allow the chute to remain open, especially during the season when the foxes are growing their new coats, as constant running and jumping through the chute wears the pelt. Chutes can be closed by the use of a slot and sliding door (Fig. 9). If the distance between pen walls is not great, one sliding door can be constructed in the middle of the chute.

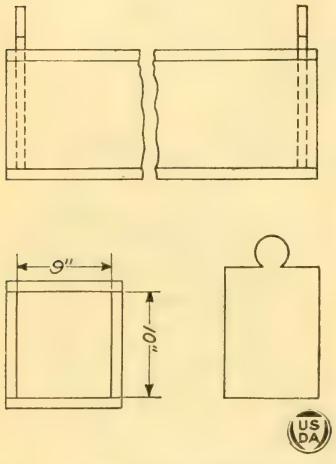


FIG. 9.—Chute with sliding door for connecting yards. This can be closed from either end by inserting door in slot.

A double pen construction assists in keeping the pens clean and sanitary, for after the foxes have occupied one for some time, say four months, they can be removed to the neighboring pen and the old one thoroughly cleaned.

### PEN WALLS.

The height of the pen wall may be 8, 9, or 10 feet. This is determined largely by the snowfall in the locality. As a rule, in the United States a wall 9 feet high is sufficient, and one 8 feet high will answer very well in some sections unless deep snowdrifts are likely to occur.

The walls should be sunk into the ground 2 feet, while at the top 18 inches or 2 feet should be allowed for an inward overhang to prevent the animals from escaping. A strip of carpet wire sometimes extends on the surface of the ground inward from the wall 2 or 3 feet to prevent the foxes from digging out, as illustrated in Figure 10. The sunken part may be turned in 1 foot or more and flat stones laid at the end to prevent escape by digging. This arrangement affords sufficient security, for experience has shown that foxes try to escape by digging at the edge of the wire only. Where

there is a solid hardpan 1, 2, or 3 feet below the surface the fence may be laid directly on it. If the subsoil is light and open, the pens are not fox-proof unless the fence extends down 3 feet. Some ranchers take the additional precaution of digging a trench and installing a concrete wall 2 feet below the surface with a 1-foot underlay.

### OVERHANG.

An inward overhang 18 inches or 2 feet wide prevents the fox from escaping from his pen, but when he has scrambled up to an overhang his only means of descent is by falling. Sometimes valuable animals are seriously injured in this way. To prevent such accidents intermediate overhangs have been developed, as well as new types of pens. Intermediate overhangs are sometimes constructed 5 feet from the ground, as shown in Figure 11, or a smooth zone is made by nailing a strip of galvanized sheet iron to the posts around the entire pen at a height of 4 or 5 feet from the ground.

FIG. 10.—Interior of fox pen, showing carpet wire laid on surface of the ground, entrance gate, and wire overhang.

### WIRE CARPETING.

On soil which is principally sand, ranchers place an entire carpet of wire a few inches to a foot below the surface. When this is done it is not necessary to dig a ditch to plant the posts and underground wire. The post holes only should be dug, the posts set in, and stones and earth put in place. The whole pen area should be excavated to a depth of approximately 4 to 6 inches. The wire netting should be cut and put in place, then laced together and to the sides of the pen. Hog rings are handy to fasten the carpet wire to the walls. An easy method of laying carpet wire is to prepare a strip of land as wide as the roll of wire to be used by shoveling the earth to one side. When this strip is shoveled clean, 4 inches deep, lay in the wire and shovel the soil back on it. Repeat the operation until the area is completely carpeted, as shown in Figure 12.

### METHOD OF CONSTRUCTION.

To construct a pen, first stake it out and line it up with a cord. Dig a trench 30 inches deep and wide enough to permit the free use

of a shovel. Care should be taken in digging this trench to keep the inside edge square and on the line laid out by the cord. Place 30-inch, 2-inch mesh, 14-gauge wire in the trench, so that the upper surface comes to the level of the ground. Lay the wire close to the inside of the trench. If desirable, the trench may be dug wider, in order to lace an 18-inch underlay of wire to the 30-inch wire at the bottom of the trench.

Set the posts in the trench so that the outside of the post comes flush or nearly flush with the inside of the trench. This helps to keep the wire straight and regular.

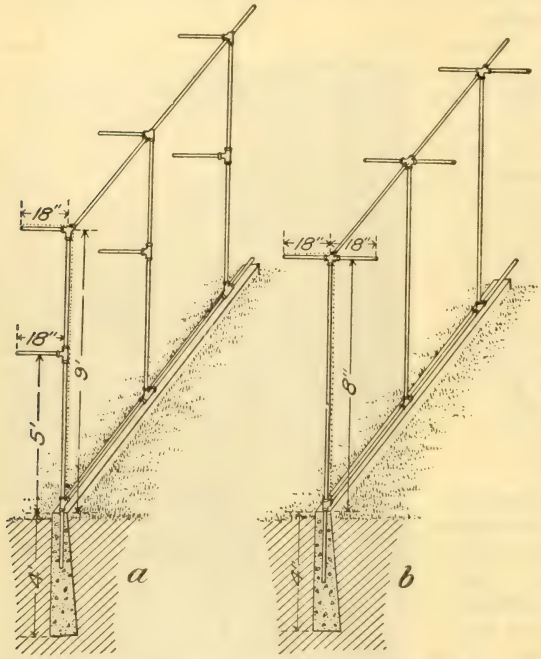


FIG. 11.—Iron posts and concrete foundations for yard fence, *a*; and guard fence, *b*. Two 18-inch overhangs are provided on the yard fence, one of which (5 feet from the ground) is to prevent foxes from climbing to the top and sustaining injury from the greater fall.

Above the 30-inch roll of wire use a 4-foot width of 1½-inch mesh, 15-gauge wire. Wire of 2-inch mesh should not be used here, because young pups may crawl through it or hang themselves; 1½-inch mesh or less is preferable.

Above this 4-foot roll use a 5-foot roll of 2-inch mesh, 16-gauge wire, which completes the height of a 9-foot pen wall. Rolls of 6-foot and 3-foot wire could be used, but it is more difficult to manipulate wire 6 feet wide in stretching. Two rolls of 4-foot wire will do if it is decided that 8 feet is high enough for the wall.

After the ground wire is placed in position stones can be packed closely around the posts and the trench filled with earth. Great care should be exercised to see that the posts are kept in line, especially when the ground is tamped solidly around them. (See Fig. 13.)

A band of 1-inch boards 4 to 5 inches in width should be nailed to the posts around the entire pen. The upper edge of the board should come flush with the top of the posts at the required height, as shown in Figure 13. This serves to stay the posts and furnishes the support to which the top wire may be stapled, as well as the outside of the overhang. It also gives a finished appearance to the pens. Brace boards should also be nailed to the top of the posts inside to furnish a place upon which a roll of 18-inch, 16-gauge, 2-inch-mesh wire can be placed to form the overhang.

The wall wire should be laced neatly together with lacing wire made for this purpose. Great care should be exercised in stretching the wire before it is permanently stapled to the posts. If it is not stretched tightly enough it will sag, thus making a very shiftless-looking job.

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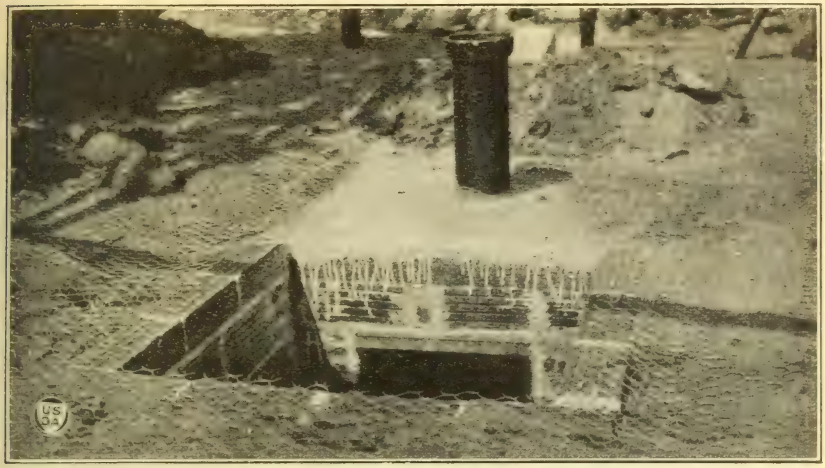

FIG. 12.—Carpet wire laid and laced in position ready for covering with 4 inches of soil, pile of which is in background.

DOOR.

After the wire is laced, stretched, and stapled and the overhang is in place, a door should be constructed. (Fig. 14.) This may be made by placing a 2 by 4 timber the required distance from one of

B21666

FIG. 13.—Pens in course of construction, showing posts lined up and ready for the wire.

the posts. One end of this should be placed on the ground and the other should extend to the top of the wall, where it should be nailed to the top board to make it rigid. The rigidity is increased by stapling the wire to it.

The door may be made as large as desired, but 2 by 4 feet is generally sufficient, unless dens are to be removed from the fox yards.

In localities where there is an exceedingly heavy snowfall it may be well to have the bottom of the door 15 inches above the ground.

The board frame should be made of the size required, and the wire cut from the opening may be stapled to the frame to complete the door. Good hinges should be provided and the door hung to a post, which may be made square, if not already so, by nailing a 2 by 4 strip to it.

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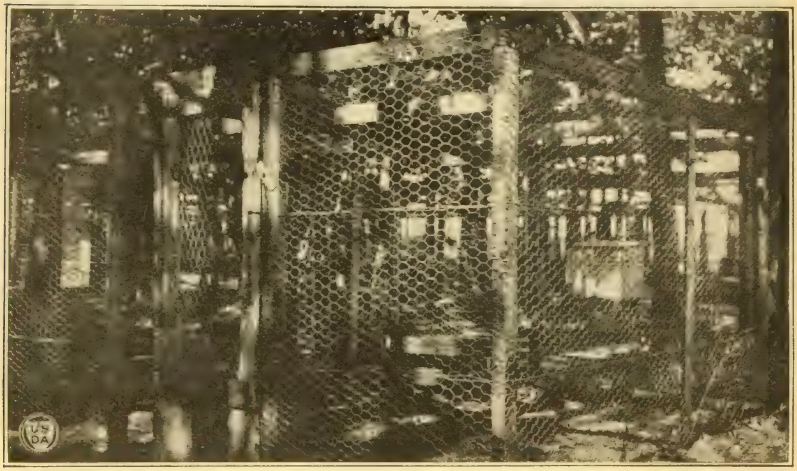

FIG. 14.—Front of completed pen, showing stretched and laced wire and door construction.

### BILL OF MATERIAL.

The following material is necessary to construct a pen 37 by 37 feet, with a 9-foot wall extending 3 feet into the ground and a 24-inch overhang and underlay:

20 posts, each 13 feet long and from 5 to 8 inches in diameter.
150 linear feet of 1-inch board, 5 inches wide.
150 linear feet of 24-inch wire netting for overhang, 2-inch mesh, No. 16 gauge.
150 linear feet fence wire, 5 feet wide, 2-inch mesh, No. 16 gauge.
150 linear feet fence wire, 4 feet wide, 1½-inch mesh, No. 15 gauge.
150 linear feet ground wire, 2½ or 3 feet wide, 2-inch mesh, No. 14 gauge.
150 linear feet of carpet wire, 30 inches wide, 2-inch mesh, No. 14 gauge.

Spikes, nails, staples, hinges, hasps, snaps, No. 16 or 18 soft lacing wire, and extra lumber for doors will also be needed. Hog rings, No. 12 gauge wire, are often used in place of lacing wire. Mesh wire, No. 15 gauge, will do very well for the pen walls, but No. 14 gauge, being heavier, makes a more durable wall. Woven wire, galvanized after weaving, is recommended because it is stronger at the joints, a place where strength is most needed. It has the further advantage of lasting longer under ground.

### CONCRETE CONSTRUCTION.

Some pens are constructed with iron posts and the foundation is of concrete.[3] Although the initial cost is much more than in those

[3] See Concrete Construction on Live Stock Farms, Farmers' Bulletin 481.

just described, the pens are more durable. (See Fig. 11.) In some ranches the floors of the pens are of concrete. This makes it much easier to keep them clean and sanitary, but it is yet to be determined whether foxes will do as well living on a concrete as on a dirt floor.

Square as well as rectangular pens with wooden posts have been set on concrete foundations, the walls of which are 4 inches wide at the top and set into the ground 3 feet, with an underlay of approximately 1 foot.

### NEW TYPES OF PENS.

The square pen and the rectangular pen have been in use ever since fox ranching was started. Both these types seem to have been very satisfactory, but a great disadvantage has been that it is very difficult to prevent foxes from climbing the wire. Foxes climb wire fences readily, but only when badly frightened. (Fig. 15.)

B1908M

FIG. 15.—Square corner of fox pen. Foxes climb such corners readily when frightened, and frequently are badly injured in falling back to the ground.

#### OCTAGONAL PEN.

In a pen of the octagonal type the maximum practicable area can be inclosed within a certain length of wire. The top of the pen may be covered with wire if desired, and then the height of the walls need be only 7 feet, a center pole being used to support the roofing. The plan shown in Figure 16 is suitable for 100 feet of wire for the walls around the pen. A pen of any size can be made in the same manner. A 2 by 4 strip running from post to post is necessary when the pen is covered over the top, to prevent the wire from drawing in the side boards between the posts. A coil-spring wire supports the wire netting, running under it from the wall posts to the center post.

#### PENS WITH SLANTING SIDES.

The walls of the pens in some new ranches are built slanting inward, at an angle of about 20°. This is for the purpose of preventing foxes from climbing the wire. Some have walls 7, 8, or 9 feet high, with an overhang similar to that recommended for pens with straight walls, while others, as in Figure 17, have walls 7 or 8 feet high and the entire top covered with wire.

### CRATE PENS.

A crate pen is easily and cheaply constructed and meets most requirements. One in which to house a pair of foxes is usually 40 feet long, 12 feet wide, and 6 feet high. A frame made of 2 by 4

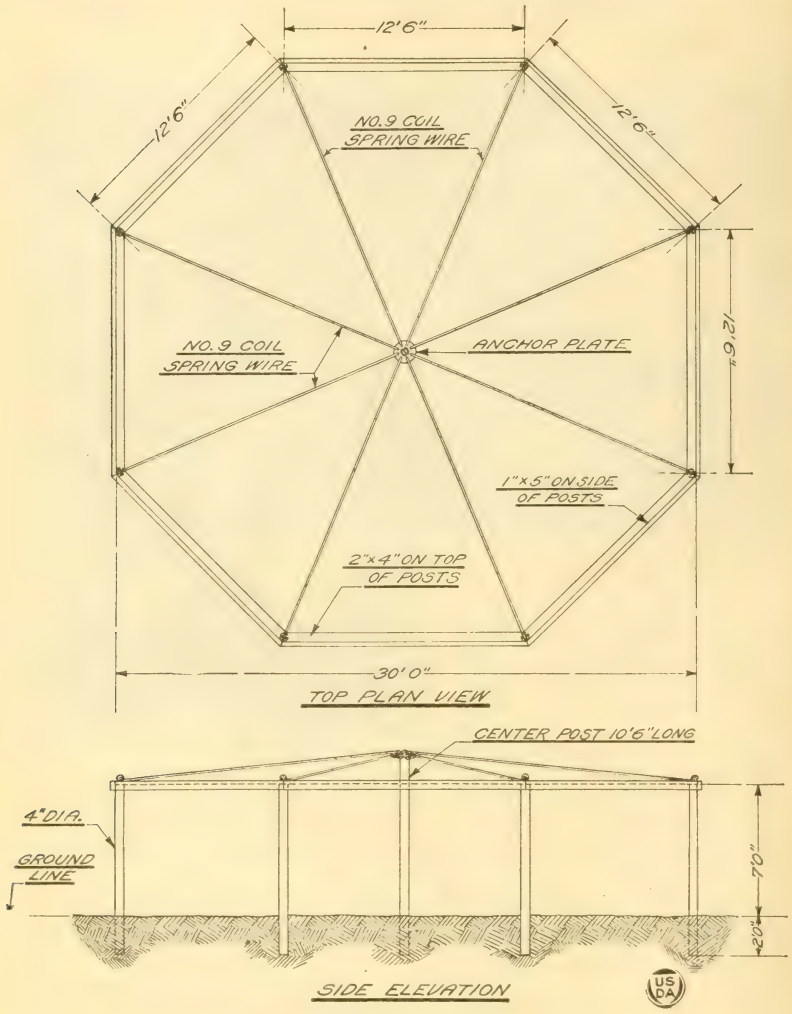


FIG. 16.—Plan of octagonal pen.

lumber is entirely covered with No. 16-gauge 1½-inch mesh wire. In the front is a door 2 feet wide and 4 feet high, the frame constructed of 2 by 4 lumber. This pen or crate rests on the surface of the ground. It is not usual to cover the netting on the bottom with soil. (See Fig. 18.)

### HOSPITAL AND TEMPORARY PENS.

Although quarters for constant occupancy should be roomy, those for temporary use, such as are required for male foxes, pups, injured,

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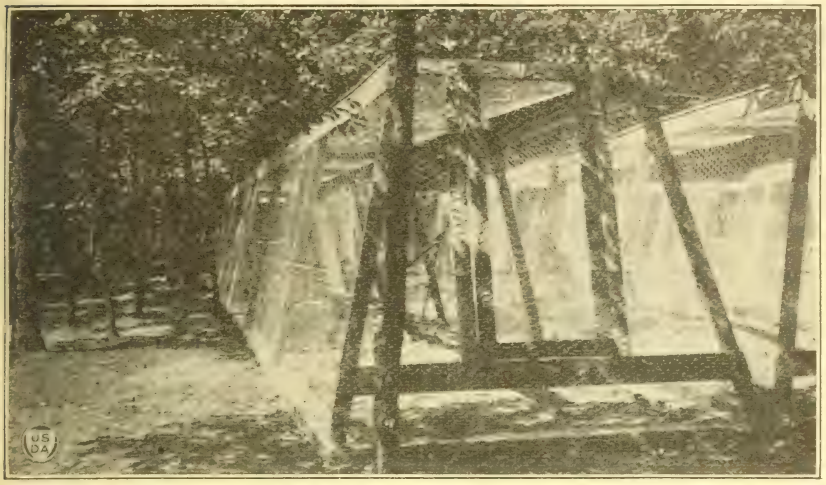

FIG. 17.—Pens with slanting sides and wire top built on concrete base. Wall may be sunk into the ground as in other pens if desired, instead of using concrete base.

sick, or newly purchased foxes, may be comparatively small. Suitable pens should be constructed for male foxes, preferably some dis-

B1988M

FIG. 18.—An entire ranch of crate pens.

tance from the breeding pens, but within the guard fence. The style and method of construction will depend upon the location and lay

of the land. (Fig. 19.) A satisfactory arrangement is to build a long, low shed with board partitions dividing it into compartments 7 feet high, 7 feet wide, and 11 feet long. These dimensions can be varied if desired, although it is not advisable to reduce them. The front and back are of wire netting, preferably 1½-inch mesh, No. 15 gauge. A door is constructed in the front of each pen in the same manner as described for breeding pens. It is well also to build a small nest box, so that the occupant of the pen may be sheltered from extreme weather.

The kind of floor is determined by the soil and the length of time the pens are to be used. On light, sandy, well-drained soils a dirt floor is satisfactory. It should be from 2 to 6 inches higher than the outside surface of the ground. Dirt floors should be renewed frequently by removing the contaminated surface down to clean soil and then refilling with fresh sand or fine gravel and earth. It should be remembered, however, that where dirt floors are used the wire netting and the side partitions will have to be sunk from 2 to 3 feet below the surface, in order to prevent the foxes

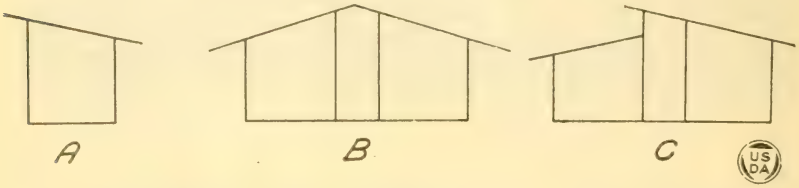


FIG. 19.—Plan of arrangement of dog and quarantine pens. *A*, pens arranged in a single row; *B*, pens arranged on both sides of an alleyway; *C*, shed with a semimonitor roof, the pens arranged on both sides of an alleyway; the advantage of this roof is that it provides better ventilation. With any of these arrangements it is possible to add more pens to the unit.

from digging out. This is not necessary with board or cement floors.

When the level of the floor in the pen is above the ground, board floors are sometimes used. However, if too low, such floors may harbor rats and rot quickly. They should be raised some distance off the ground to facilitate cleaning under them.

Cement floors are satisfactory when an artificial floor is required and can be built on the ground level. They are generally used in pens intended for sick or injured animals. These floors are easy to clean, sanitary, rat-proof, and comparatively inexpensive if a supply of gravel or sharp sand is available.

It is essential on a large ranch to have a group of isolated pens in which sick or injured animals, or those newly purchased, can be quarantined.

A temporary pen, used for the purpose previously described, may be 10 feet long, 6 feet wide, and 4 or 5 feet high. A frame of 2 by 4 material is entirely covered with netting of 1½-inch mesh, No. 15 gauge wire, and a small door placed in the front. As the pen rests directly on the surface of the ground, it is well to cover the floor wire with sand or fine gravel and earth. This material should be removed frequently and clean dirt substituted to prevent the soil from becoming contaminated. A small nest box can be placed inside the

pen, or it may be outside and connected with it by a chute such as has been described (see page 12).

The cheapness, security, and portability of these pens make them a very useful adjunct. Every fox ranch should have a number of them. They are not only suitable for male foxes and sick or injured animals but may be used for the pups taken from the mother when they are 2 months old. If this is done the dog may be returned to the breeding pen with the vixen[4] and the pups put in the dog pen. Animals that appear to be very thin may be placed in the small pens and given individual feed and attention.

### EXERCISING CRATE.

The main purpose of the exercising crate shown in Figure 20 is to provide a place for the pups to sun themselves without getting

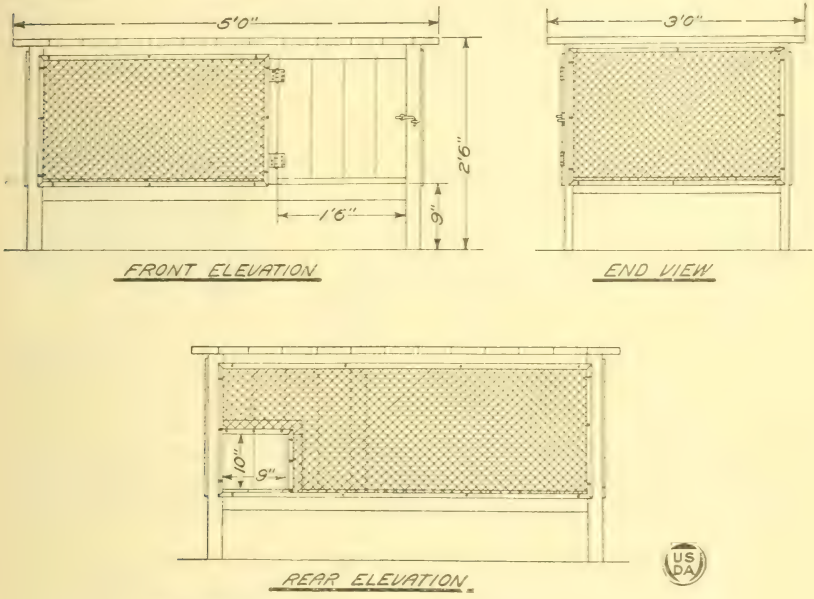


FIG. 20.—Details of construction of exercising crate.

into the slush and mud that might chill them or even result in their contracting pneumonia. Feed can be placed in it, thus facilitating the feeding of the mother and pups during the lactation period. This crate is easily and cheaply constructed, the floor elevated 9 inches above the ground. The uprights and braces are of 2 by 4 material, and the outside dimensions are 5 feet long, 3 feet wide, and 2½ feet high. The floor and roof are of tongue-and-groove boards of any convenient width. The door may be either of wire or of wood. The wire surrounding the crate is 2½-inch mesh, No. 15 gauge. The den and exercising crate should be connected by a chute 4 feet long, 10 inches high, and 9 inches wide (Fig. 21). Two sliding doors are inserted in the chute, so that the foxes can be shut in or out of the den or exercising crate as desired.

[4] "Vixen" is the name given to the female fox; "dog" to the male.

## DENS OR KENNELS.

Dens or kennels are built mainly for the purpose of sheltering the foxes and furnishing a place for the vixen to whelp her young. They are built some distance off the ground to prevent foxes from digging under them and to furnish shade, and should be so constructed as to protect the occupants from extremes of heat and cold, to exclude moisture, and to deaden sound. These features are particularly important during the breeding and whelping periods, when foxes are usually nervous and when the pups can not stand exposure. Fresh air should be obtained by ventilation (see Figs. 23, 31, 32, and 33) rather than by providing more cubic feet of air space than is required, but it is extremely important to avoid the creation of drafts. As the dens and nest boxes require frequent cleaning and spraying to keep them free from vermin, the construction should be as simple as possible. The convenience of the caretaker is a matter that is to be kept in mind as well as the comfort of the foxes.

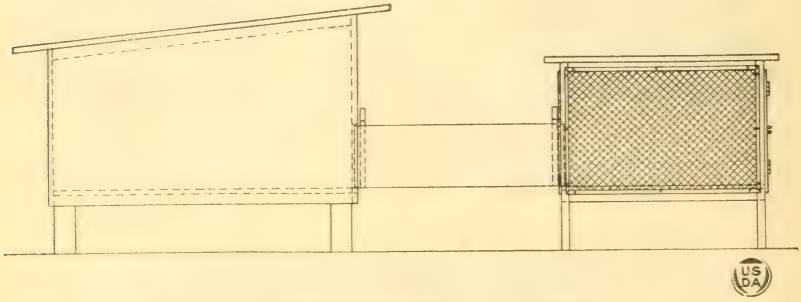

FIG. 21.—Connection between den and exercising crate.

The walls, floor, and roof are generally double boarded with building or tarred paper between the boards. All rough edges that a fox might rub against should be smoothed and sandpapered, to prevent injury to the pelt.

The roof of the den is generally covered with tarred paper, shingles, or metal. This is not necessary if it is to be double and made of tongue-and-groove boards. It is well, however, to give it two coats of paint or to creosote the boards. Creosoted boards, however, will not take paint.[5]

Chutes through which the foxes enter the den from the yard should be so constructed that they can be hooked to the den and easily removed. They should have a slight rather than a steep grade, so that the pups can crawl back into the den. In every type of den the back and roof should be made on hinges to afford access to the interior without unnecessary noise and to facilitate cleaning.

### DOUBLE-BOX DEN.

The double-box type of den has been found very satisfactory, as it facilitates catching the foxes for inspection and provides a convenient place for starting the pups on feed. It consists of two

[5] See Use of Paint on the Farm. Farmers' Bulletin 474.

boxes, with hinged sloping tops, set about 18 inches apart and on legs 18 inches high, as shown in Figure 22. The two are connected by a chute 9 inches wide and 10 inches high, the entrance from the ground being into the smaller box through a sloping chute 4 or 5 feet long. Each chute is fitted with a slot and sliding door, and both should be so constructed as to be easily hooked in place or taken off when the dens are to be moved or cleaned. When it is desired to look at a fox in the larger den, the caretaker closes the door in the connecting chute and then lifts the hinged roof. By closing both doors inspection may be similarly made in the smaller box, which is used chiefly as a feeding place for the young and as a place in which to separate them from the parents.

The walls of both dens are double and lined with building paper. The outside base measurements of the larger should be 4 or 5 feet by 2½ or 3 feet, and of the smaller 3 by 1½ feet. The front of the larger should be 2 feet high and the back 1½ feet, while in the smaller these heights should be 1½ feet and 14 inches, respectively. The larger den is partitioned so that a room is made in the far end for a nest chamber for the use of the vixen and her young at whelping time. The nest box is of dressed lumber, 18 inches long, 15 inches wide, and 15 inches high, and is also provided with a hinged lid. A chamfered strip is fitted against the floor and sides to prevent the pups from rolling too far away from the mother, and is an aid also in cleaning the nest box. The spaces between the wall of the nest box and the main wall of the large den are filled with dry sawdust, oat hulls, ground cork, or other suitable material.

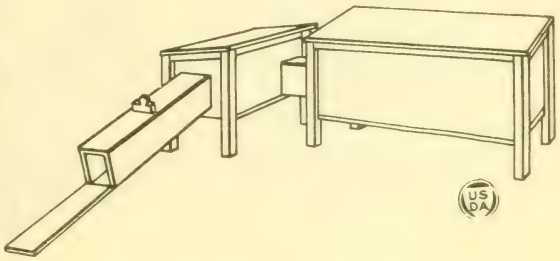

FIG. 22.—Double-box den.

### DEN WITH REMOVABLE NEST BOX.

A most convenient den from the standpoint of the caretaker, and one very simple to construct, is made with a removable nest box. This box is fastened in temporarily in the front part of the den by a board fitted in slots in the sides, in order to prevent the foxes from moving it about, thus causing accidents to the vixen or to the pups. The detailed construction is shown in Figure 23. The outside base measurements are 4 by 1½ feet, the front is 2½ feet high, and the rear 2 feet. It is double walled and lined with building paper. A chute, 9 by 10 inches, that can be hooked to the den and removed whenever necessary, leads from the entrance to the ground, as shown in Figure 22.

### DOUBLE-COMPARTMENT DEN.

A very simple and useful den is constructed in two compartments and entered from the outside by separate chutes, as in Figure 24. It is 4 feet long, 2 feet wide, and 2 feet high (outside measurements), double walled, with building or tarred paper between the walls.

Each compartment or nest box is 20 inches square, the inside construction being of the same general character as that described for the double-box den. The chutes are 9 by 10 inches by 4 feet, and the opening into the chute is on one side, to prevent direct drafts. The top or roof of the kennel is hinged. In Figure 25 is illustrated a double-compartment den with one chute entrance.

### BARREL DEN.

The barrel den shown in Figures 26 to 29 is still in common use, more as a shelter for the foxes, however, than as a whelping nest. In ranches where there are two dens, or kennels, in a single fox pen

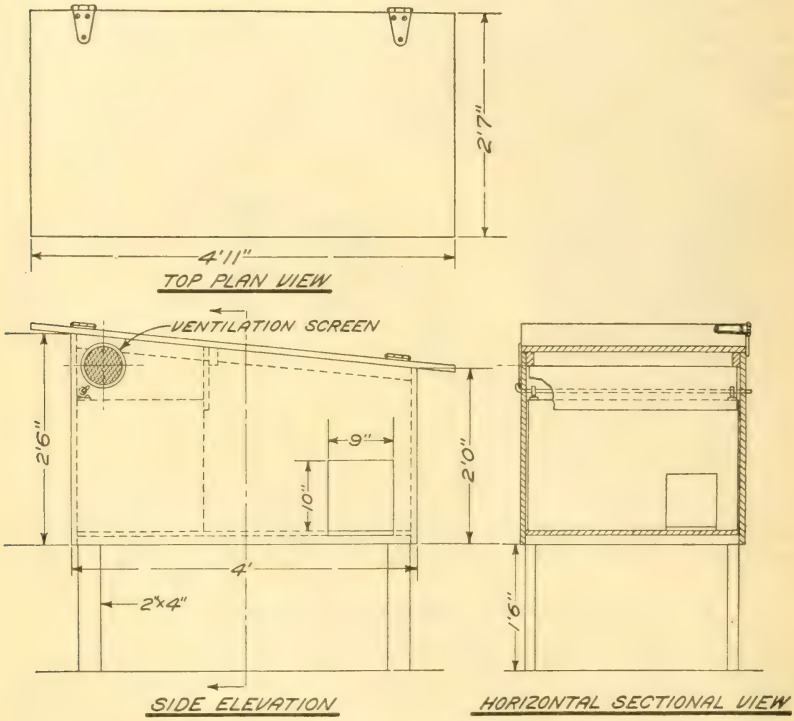


FIG. 23.—Practical den with removable nest box.

one is generally of this construction. It is made of a clean barrel placed inside a protecting box, the space between the two being filled with oat hulls or other materials, the best material to be used depending largely on what is most easily obtainable. An entrance hole, 9 by 10 inches, is made in one end of the barrel, and a similar opening in the upper side for inspection, cleaning, and ventilation. The barrel should have a smooth interior. A screen door is hinged above the barrel to prevent the foxes from escaping when the cover is raised, and a sheet of burlap tacked to one side of the frame and spread over the netting when the cover is raised for ventilation will keep out air currents and light. At the entrance hole is an elbow spout $2\frac{1}{2}$ feet in the shorter arm and 6 feet in the longer.

HOUSE WITH NEST BOX USED EITHER AS A SHELTER OR A DEN.

A shelter for the male fox is used rather commonly, especially where two dens are used in a single pen. A type for the purpose,

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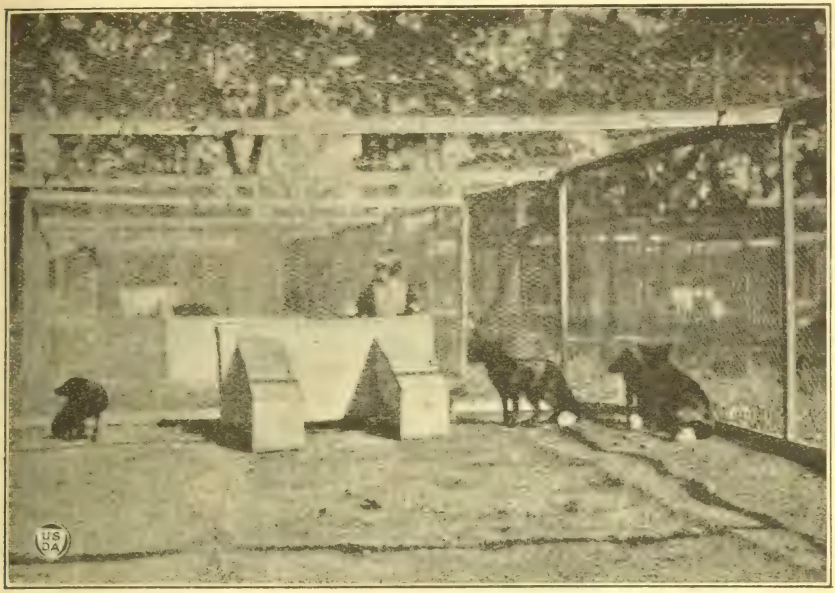

FIG. 24.—Double-compartment den with separate chutes.

which is popular with ranchers using underground dens, is illustrated in Figure 30. During the breeding season a nest box is put

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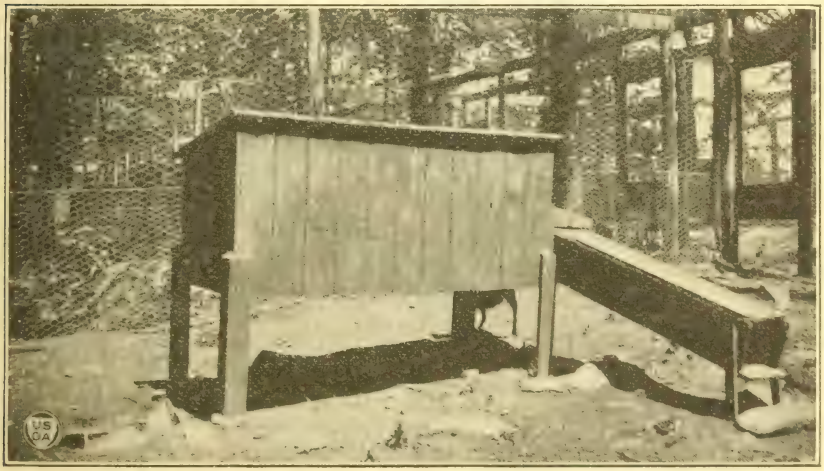

FIG. 25.—Popular type of double-compartment den with single chute.

into it for the vixen to whelp her young. The construction described for other pens applies to this, with the exception of the dimensions.

The outside base measurements are 3 feet 6 inches long by 2 feet 10 inches wide, the front side 2 feet 7 inches high and the rear 2 feet 1 inch.

### UNDERGROUND DENS.

The underground den is a recent type. Advantages claimed for it are that it deadens sound and preserves an even temperature all the year round, thus protecting the foxes from extremes of heat or cold; it is an exceptionally cool place on hot days in summer. This den will prove satisfactory only in light, well drained, chiefly sandy, soils; it is not practicable in heavy soils or in those containing outcroppings of rock which make excavation very difficult. Figure 31 gives plan of construction.

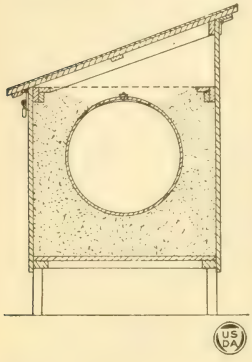

FIG. 26.—Vertical cross section of barrel den.

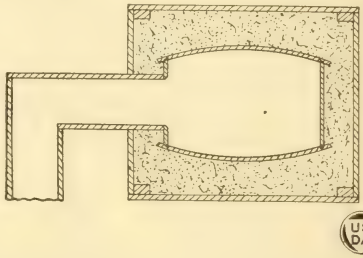

FIG. 27.—Horizontal longitudinal section of barrel den.

Underground dens are made chiefly of wood, but a few ranchers have used hollow building blocks and cement. It has yet to be determined whether the last-mentioned materials make the foxes more comfortable. The main parts are assembled before being placed in the hole excavated for the purpose. The den proper is generally placed in an alleyway between the pens, while the chute runs from the den into the pen yard. Inspection is made through the manhole at the top without going into the fox pen. Figure 32 shows the arrangement of dens in the alleyway.

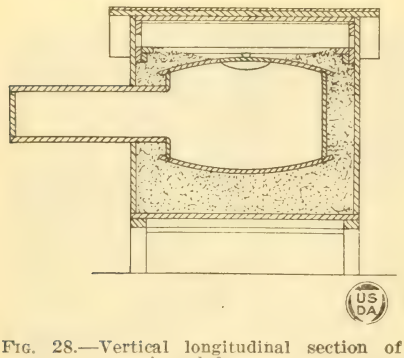

FIG. 28.—Vertical longitudinal section of barrel den.

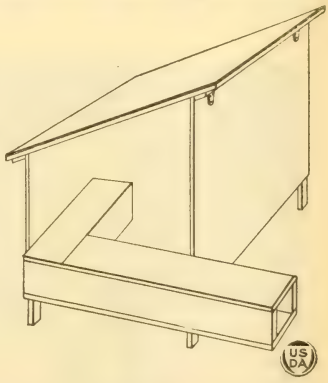

FIG. 29.—Exterior view of barrel den.

### NEST BOXES.

The nest box is the home of the pups and the mother for some time, and should be large enough to prevent crowding, but small

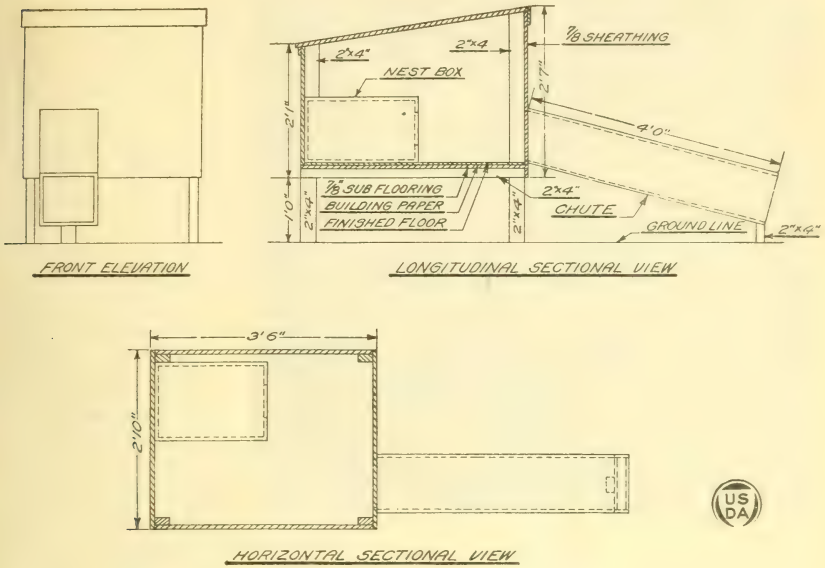


Fig. 30.—Simple type of aboveground den.

enough to keep the occupants warm by their own body heat. A good size is 22 inches long, 18 inches wide, and 20 inches high. The entrance is 8 inches square and is not centered, but placed to one side to keep drafts from striking the pups. Chamfered strips placed on the floor at the corners prevent the pups from creeping too far away from the mother. (Fig. 33.)

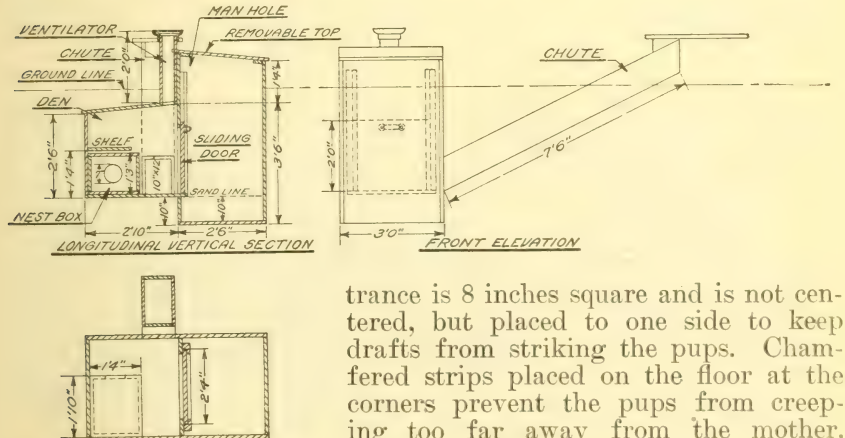


Fig. 31.—Underground den.

The nest box should be fastened in the den in some temporary manner, by hook and eye or slat boards, as it is important to be able to remove it for cleaning and during the summer, when not needed. It should have a hinged cover or removable top

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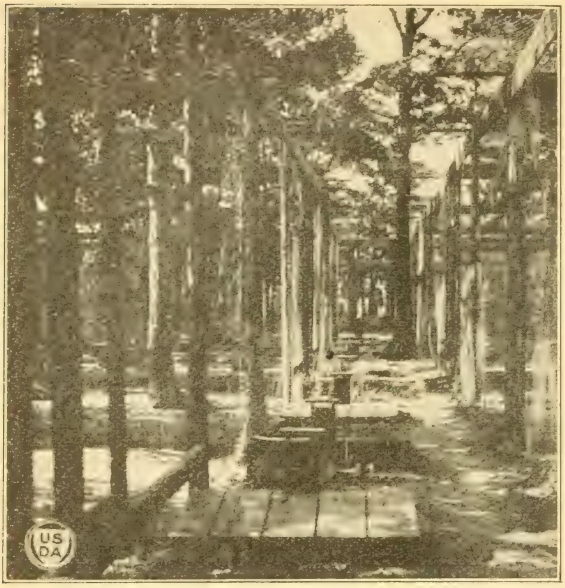

FIG. 32.—Arrangement of underground dens, showing ventilation, the den properly located in alleyway.

to facilitate cleaning and to permit the removal of foxes or pups. Several holes one-half inch in diameter bored in the cover furnish ventilation. The nest is kept warm by being packed on all sides with dry sawdust, oat hulls, ground cork, leaves, seaweed, chaff, or sand.

A solid box with a hole in one end is commonly used for a nest box, but it is impractical from the caretaker's point of view. (Fig. 34.) With such a box it is almost impossible to remove a fox or pup without picking up the box bodily and dumping out the contents. If the caretaker reaches in for the purpose of dragging out a fox or pup he is almost certain to be bitten.

## THE WATCH TOWER, OR LOOKOUT.

The watch tower, or lookout, is used for the purpose of observing and studying the behavior and habits of the foxes and their conformation, tricks, and general make-up during various seasons of the year, but more especially during the breeding and whelping periods. It is a most necessary adjunct to fox raising, and without it on a ranch of more than 10 pens the caretaker is greatly handicapped.

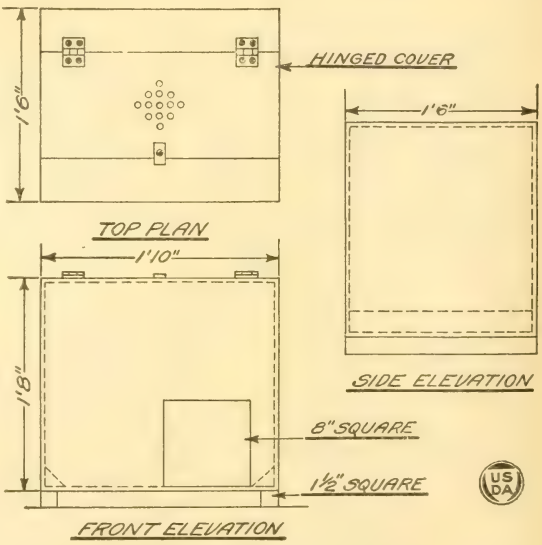


FIG. 33.—A good type of nest box.

The location of the tower depends on the topography of the land and the size of the ranch. The center of the ranch is often chosen, but any convenient place from which the foxes may be observed is satisfactory. It is questionable, however, whether the natural behavior of the foxes can be observed to as good advantage from a tower inside the ranch as from one outside, for the presence of the caretaker going to the lookout puts the foxes on their guard. To save labor and material and to afford a better lookout it is well, where possible, to place the tower on a rise in the land. Field glasses facilitate close observation, but are not essential. If the ranch is spread out over a considerable area it may be necessary to construct two or more towers in order to obtain a view of all the foxes in all the pens. (See Figs. 35 and 36.)

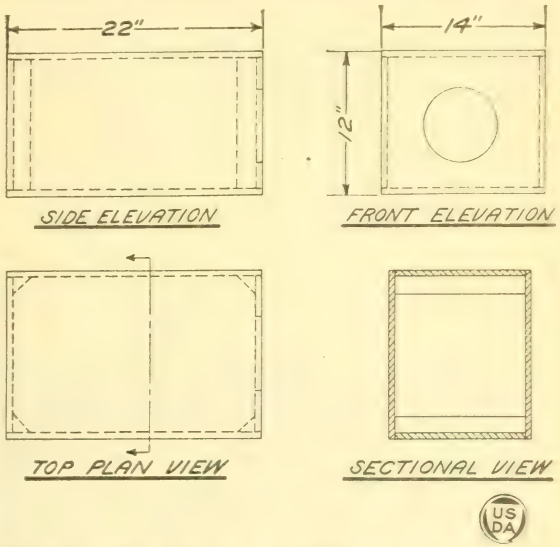


FIG. 34.—Type of nest box in common use but very impractical from the standpoint of sanitation and convenience in handling.

There are various types of watch towers, but the main point is to have a building of sufficient height to afford a good view of all pens.

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FIG. 35.—Arrangement of watch tower (outside of guard fence), rancher's cottage, and outbuildings.

It may be one, two, or three stories high, the top story only being used as a lookout. A desk, chair, and small heating stove are all the furniture necessary. The floors not used as a lookout may be used for storing tools, feed, feeding utensils, or other equipment.

The extra floor space may also be used when skinning the foxes and curing the pelts.

## GUARD FENCE.

The guard fence serves to keep dogs and other intruders away from the breeding pens and in addition provides greater security, for in case a fox escapes from a pen it may be captured within the

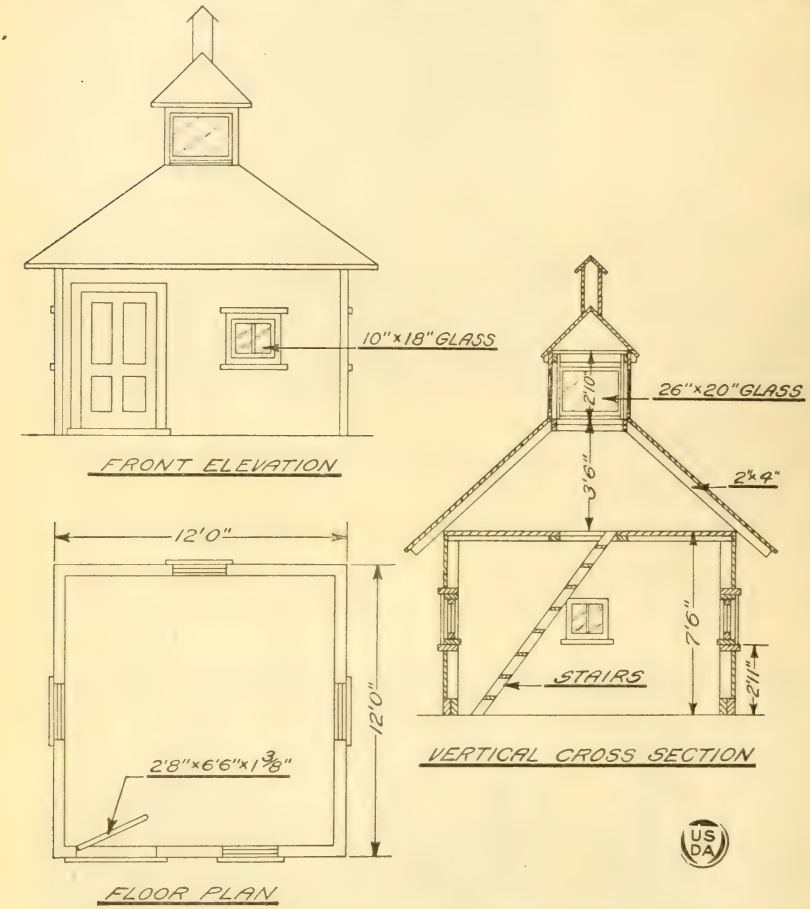


FIG. 36.—Plan of watch tower commonly used in circular ranches.

outer fence. It may be of wire (Fig. 11) or wood (Fig. 37), or a combination of the two, and may be constructed like the pen wall already described. Boards for the first 6 feet, with the addition of an upper 4 feet of wire netting, are frequently used; on the ground, inside, carpet wire 2 feet wide is nailed to the boards. The type of guard fence to be built depends upon the location of the ranch. If it is in a secluded spot, away from general annoyances, it is well to make it entirely of wire. In other cases it should be built partly or all of wood.

If the ranch is in a wood lot the guard fence may be of wire 9 or 10 feet high and constructed in the same manner as the walls of the pen, with the exception that the carpet wire may be laid on the surface of the ground and laced to the wall wire at the ground level, as shown in Figure 10, or, in the case of a board fence, stapled to it. To prevent it from turning up, the other edge of the wire should be stapled to stakes driven into the ground. In localities where there are severe winters and the snow drifts badly, the fence should be built of boards, especially on the north and west sides, to prevent snow from piling up in the yards.

On flat, level land, or land having a decided southern exposure, a guard fence of boards 9 feet high will keep air from circulating freely through the ranch, unless placed 20 or 30 feet away from the

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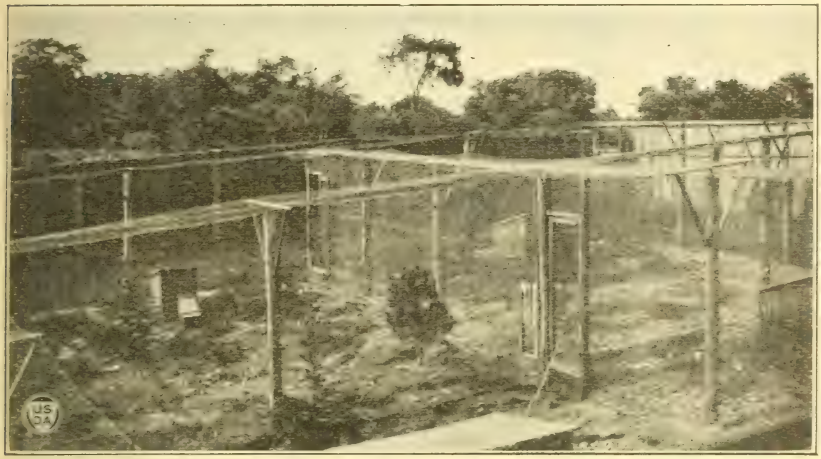

FIG. 37.—Ranch surrounded by guard fence entirely of wood.

pens. If the ranch is located on a slope exposed to frequent summer breezes it is not necessary to place the fence at such a distance.

## ADDITIONAL EQUIPMENT.

Not all of the equipment listed in the following paragraphs is essential to the successful operation of a fox ranch. How much will be needed depends upon the number of foxes kept for breeding purposes.

A rancher's cottage, slaughterhouse, refrigeration plant, feed house, bake oven, and barn are some of the essentials on large ranches.

An outbuilding should be constructed for use as a feed house, the size depending upon the number of foxes to be fed. Its sole purpose is for storing and preparing the feed. A good location is outside the guard fence a short distance from the ranch. It may be desirable to install in this house a steam cooker, a meat and bone grinder, and a steam bath in which to sterilize the feed dishes. Such a building may also include an ice house if the size of the business warrants. It should be used strictly as a feed house and not as a place in which to store tools, to pelt foxes, or treat sick foxes, or as a loafing place

for the help on the ranch. If there is no convenient place to store tools or to pelt foxes it would be well to construct a building for this purpose.

Some ranchers have the guard fence lighted or strung with charged wires to keep out robbers.

Feed pans or dishes are essential and their kind and use will be taken up later under "Feeding." Other pieces of equipment are discussed under "Handling" and "Pelting."

## ESSENTIALS OF BREEDING.[6]

Those engaged in raising foxes should have a clear conception of the important factors involved in breeding. Mendel's law has a direct and practical application to the breeding of silver foxes, and an understanding of its principles is vital to success in the enterprise. The silver fox being a recessive, always breeds true, with some degree of silver, but not always a desirable type. It is found in actual practice that Alaskan silver foxes bred to standard silvers will produce cross foxes in the litter.

### METHODS OF SELECTION.

Success in fox raising is directly dependent upon a careful and intelligent selection of the right type of breeding stock. By type is meant the sum total of certain features, the possession of which makes a fox meet definite requirements for the production of a high quality of fur. Only those individuals meeting standard requirements should be selected for breeding purposes. Pedigreed foxes as such do not always do this; some registered foxes are detrimental to any ranch, being not only inferior in type but worthless in fur value.

#### PELTS.

The real basis for selecting foxes for breeding purposes is the quality of fur produced by the offspring, the indications from conformation (see p. 33) occupying a secondary place. In the case of sheep, wool production is judged directly and the same should be true of the fox and its fur.

The pelt of a fox should be perfectly and evenly furred all over, both on the back and on the belly. The fur should be reasonably long, lustrous, and silky in appearance. These characters determine the quality. The guard hairs, whether silver banded or black, should be long, fine and silky in texture, and longer in the region of the nape than on other parts of the body. The underfur should be abundant, soft, and dark in color, the darker the better. Matty or woolly underfur is not desirable.

When prime, a silver fox should be black and silver, the glossy black shading to blue black. The silver bands on the guard hairs should be bright in color. The color must be clear, whether the fox is classed as black, extra dark silver, dark silver, silver, or pale silver (see frontispiece), for clearness of color is one of the most important

[6] For a comprehensive treatment of this subject see Principles of Live Stock Breeding, by Sewall Wright: Bull. No. 905, U. S. Dept. Agr., 67 p., 25 figs., 1920; and for a discussion of the subject in popular style, see Essentials of Animal Breeding, by George M. Rommell: Farmers' Bulletin 1167, U. S. Dept. Agr., 37 p., 32 figs., reprint, 1921.

FIG. 1.—MALE SILVER FOX.

A good type of the dark silver; foxes such as this show strong evidence of breed character, masculinity, and impressiveness.

FIG. 2.—FEMALE SILVER FOX.

An excellent type of adult vixen, medium silver.

factors in determining quality. Smuttiness and deficiency in luster and a rust or tinge, which give a brownish or chocolate cast to the fur, detract from the value of the pelt. A fox possessing a rusty pelt, no matter to what degree, should be eliminated; a perfectly furred pelt slightly tinged is less valuable on the fur market than one fairly well furred but clear in color.

Much has been said about the cause of rust or tinge, and it has been attributed both to feed and to sunlight. It is well known, however, that both rusty and clear-colored pelts can be found on the same ranch, where identical feeding methods are followed and where the sunlight is approximately the same in every pen. It is probable, therefore, that heredity is the determining factor in rustiness and that the character can be eliminated by careful selection.

The term "samson" is applied to foxes devoid of guard hairs and carrying a very inferior woolly underfur. This condition has been variously attributed to breeding, feeding, and parasites. The real cause is not definitely known, and for this reason it is highly inadvisable to use such foxes for breeding stock. The pelts have small value on the market.

The brush should be reasonably long, in order to balance properly the length of the body, and should carry a white tip 2 to 4 inches in length. The general principles determining the quality of the fur on other parts of the body are equally applicable to the brush.

### CONFORMATION.

Conformation involves the individual structure of each part as a unit. A defect in any part offsets to some extent an otherwise perfect structure. Some parts, as the chest, back, loin, or leg, are relatively of greater importance than others; a deficiency in such parts would have more effect on the serviceability of the whole than a similar inferiority elsewhere.

The vixen (Pl. II, Fig. 2) should show much refinement about the head and ears and should be wide between the eyes. She should be long, deep, and roomy in body, wide through the hips, and full in the heart girth. The body width should be uniform from chest to tail head. The dog (Pl. II, Fig. 1) should be similar in make-up and possess a rugged masculine appearance rather than the refinement found in the vixen. Constitutional vigor is evidenced by a well-developed heart girth, chest, front flank, and loin, and both vixen and dog should be deep, wide, and well coupled in these regions (Fig. 38). There should be no indication of a pinched appearance behind the shoulders or in the loin. If breeding foxes are strong in these regions it is safe to assume that, other things being equal, they have strong lungs and heart, and consequently are stronger, healthier, and more able to resist disease.

### THE BREEDING RECORD.

The best evidence of the value of any animal for breeding is found in its offspring. The possession of prepotent foxes of the desirable kind means more for progress than any other factor. Wright defines a prepotent animal as one that however mated impresses its characteristics on all its progeny, and adds that pre-

potency is a property of characteristics and not of individuals, breeds, or sexes.[7]

The secrecy which surrounded the breeding of silver foxes in the early days is largely responsible for the present lack of information regarding ancestry and breeding. In general, no systematic records were kept of pelt production, breeding, and pedigree, and for this reason prospective buyers are compelled to rely largely on the word of the seller. A few breeders, however, have been far-sighted enough to see that records regarding the quality of fur produced are necessary to the successful conduct of fox breeding as a business. There is probably nothing that will make more for progress than the systematic maintenance of the breeding record of promising foxes based on the production of a high quality of fur.

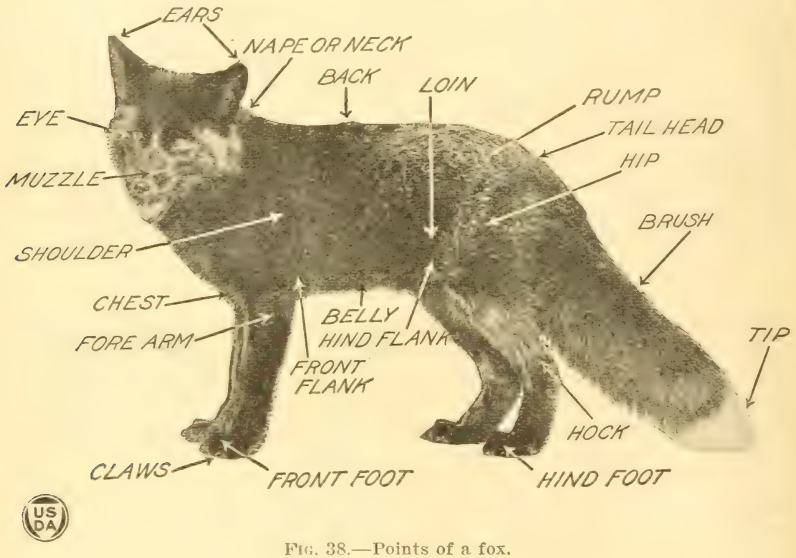


FIG. 38.—Points of a fox.

## PEDIGREE.

Selection must be based on the ancestors as well as on the individual. An inferior fox of good pedigree is in every way preferable to a better-appearing individual of unknown ancestry. The selection of either of these individuals as a breeding fox might prove disastrous, but the latter offers by far the greater chance of unsatisfactory results. The best test of the breeding powers of a fox is to see the progeny. Rarely are a pair of foxes of proved excellence as breeders offered for sale, and selections must generally be made from untested stock on the basis of individuality and pedigree. The value of particular individuals in the pedigree depends on the degree of relationship. A good sire or dam is a very important consideration; the grandparents, when judged by themselves, do not have so much weight; and remote ancestors need hardly be taken into consideration.

[7] Bull. 905, U. S. Dept. Agr., p. 34.

In judging the value of a pedigree it is important to give as much weight to the inferior animals represented as to the superior. Unfortunately, it is not possible to learn much of the characteristics of any but the latter class. Superior foxes would be classed as those descended from high-grade pelt producers and the winners of prizes in well-judged fox shows. It is evidently extremely difficult to judge quickly and accurately the amount that a certain pedigree adds to or subtracts from the value of a fox as an individual. The early history of fox breeding can not be learned from books, since at first no accurate records were kept. Recent history, which is more important, can be learned by following the results of fox shows and fur sales for a number of years and by keeping in touch with current fox journals.

The pedigree of registered pure-bred foxes can be obtained from one of the associations registering foxes. The following associations at present register foxes in the United States and Canada.

American Silver Fox Breeders' Association, 227 Congress Street, Boston, Mass.

National Silver Fox Breeders' Association of America, 204 Rosen Block, Muskegon, Mich.

Canadian National Silver Fox Breeders' Association, Summerside, Prince Edward Island, Canada.

Silver Black Fox Breeders' Association of Prince Edward Island, Charlottetown, Prince Edward Island, Canada.

## BREEDING.

It is to be constantly borne in mind that silver foxes are not domesticated animals in the true sense of the term. The purpose of breeding silver foxes is not merely to increase their numbers but to produce a uniform product and improve the stock. A uniform product depends upon such knowledge and control over the heredity of the stock that matings may be made with assurance that the offspring will be of the certain definite type in demand. Improving the stock, of course, is closely related to control over heredity, but the methods which give the greatest control are not necessarily those which lead to the most rapid improvement.

The business of fox ranching is new, and he who would succeed in it must give it careful thought, study the moods of the animals, and prepare himself to meet intelligently emergencies as they arise. Many companies formed for the sole purpose of raising foxes have failed because of the great difficulty in hiring a keeper having the necessary personal interest. To an even greater extent such failures have been due to the tendency of stockholders who know nothing about the industry to urge purely theoretical and impractical methods. The more thoroughly a man studies breeding practices and his foxes the more closely he may approach a desired degree of fixity in his breeding operations.

### INBREEDING.

Of the effective means of improving the stock at the command of the breeder, next in importance to selection is the judicious mating of related animals. This process is known as inbreeding.[8] It should

[8] See Farmers' Bulletin 1167, U. S. Dept. Agr., p. 20.

be practiced, however, only by the most skillful breeders, and by them only when they have definite knowledge of ancestry.

Each breeder will have to decide for himself whether he will practice inbreeding with his foxes. Inbreeding tends to fix characters that can be fixed, but one of its most valuable uses is in bringing clearly to light the relative merits of different strains in such characteristics as fecundity, resistance to disease, and the like, which are affected so much by factors other than heredity that they can not be fixed in individuals. In these respects progress is more likely to result from the selection of strains than of individuals.

### BREEDING AGE.

Because of the tremendous prices paid for breeding stock and for pelts in the early days of the fox industry, little thought was given to the important problem of improved breeding. The age at which silver foxes should be bred has likewise been given very little attention or consideration, the general practice being to select the best foxes from the pup crop produced in spring for mating late in fall or early in winter. Most of the foxes used for breeding purposes, therefore, are first so used at the age of 10 months, and if the first season's mating is successful the vixen produces her first litter before she is 1 year old.

Breeding and feeding are now receiving more serious thought. A number of breeders believe that better pups are produced if the vixen skips the first season without producing a litter, but just as many favor the production of a litter the first year. Some may think that they have definitely settled this matter, but among breeders generally it is a much-debated question.

Domestic animals as a rule make most of their growth during the first year. This is also true of foxes. Intelligent live-stock breeders deem it a serious mistake to breed females under a year, for the reason that nature has not fitted them to become mothers at this early age. Animals born from underaged mothers are generally small and weak, and in spite of good care and feeding the mother too often does not supply sufficient milk to nourish the offspring. This occurs rather commonly among foxes bred the first year, although it can not be definitely stated that it is caused by early breeding. If a rancher follows the practice of breeding his animals too young he may find in a few years that the offspring are degenerating in size, constitution, and quality. Objections to early breeding may not apply directly in the silver-fox industry, but they are worthy of consideration until the facts are definitely established.

### TIME OF BREEDING.

The mating season occurs principally during the months of February and March. The oestrum, or heat period, occurs once a year and lasts about three or four days; and while the vixen will accept service only at this time it seems to make little difference whether it is early or late in the period. Service has been observed to be accepted many times during the period of heat, but as a rule not more than one service is necessary to insure conception.

The gestation period is 51 or 52 days, and the young are usually born in April and May. Young born between April 15 and May 15

have better chances to develop and grow to maturity than those born at earlier or later dates. Generally the growth of very early pups is retarded by cold weather, while extremely late pups are handicapped by heat and flies.

The breeder should make every effort to ascertain the date of breeding. By keeping a service record he is able to determine accurately when to expect the pups. Table 1 shows the breeding and whelping dates for service on any day from January 1 to April 30, the calculations being based on a 51-day gestation period.

TABLE 1.—*Dates of breeding and whelping, based on 51-day gestation period. The first line of dates in each column indicates the date of breeding and directly opposite in the same column is the date on which the vixen may be expected to whelp.*

| | | | |
|---|---|---|---|
| Jan. 1–Feb. 20 | Feb. 1–Mar. 23 | Mar. 3–Apr. 22 | Apr. 2–May 22 |
| Jan. 2–Feb. 21 | Feb. 2–Mar. 24 | Mar. 4–Apr. 23 | Apr. 3–May 23 |
| Jan. 3–Feb. 22 | Feb. 3–Mar. 25 | Mar. 5–Apr. 24 | Apr. 4–May 24 |
| Jan. 4–Feb. 23 | Feb. 4–Mar. 26 | Mar. 6–Apr. 25 | Apr. 5–May 25 |
| Jan. 5–Feb. 24 | Feb. 5–Mar. 27 | Mar. 7–Apr. 26 | Apr. 6–May 26 |
| Jan. 6–Feb. 25 | Feb. 6–Mar. 28 | Mar. 8–Apr. 27 | Apr. 7–May 27 |
| Jan. 7–Feb. 26 | Feb. 7–Mar. 29 | Mar. 9–Apr. 28 | Apr. 8–May 28 |
| Jan. 8–Feb. 27 | Feb. 8–Mar. 30 | Mar. 10–Apr. 29 | Apr. 9–May 29 |
| Jan. 9–Feb. 28 | Feb. 9–Mar. 31 | Mar. 11–Apr. 30 | Apr. 10–May 30 |
| Jan. 10–Mar. 1 | Feb. 10–Apr. 1 | Mar. 12–May 1 | Apr. 11–May 31 |
| Jan. 11–Mar. 2 | Feb. 11–Apr. 2 | Mar. 13–May 2 | Apr. 12–June 1 |
| Jan. 12–Mar. 3 | Feb. 12–Apr. 3 | Mar. 14–May 3 | Apr. 13–June 2 |
| Jan. 13–Mar. 4 | Feb. 13–Apr. 4 | Mar. 15–May 4 | Apr. 14–June 3 |
| Jan. 14–Mar. 5 | Feb. 14–Apr. 5 | Mar. 16–May 5 | Apr. 15–June 4 |
| Jan. 15–Mar. 6 | Feb. 15–Apr. 6 | Mar. 17–May 6 | Apr. 16–June 5 |
| Jan. 16–Mar. 7 | Feb. 16–Apr. 7 | Mar. 18–May 7 | Apr. 17–June 6 |
| Jan. 17–Mar. 8 | Feb. 17–Apr. 8 | Mar. 19–May 8 | Apr. 18–June 7 |
| Jan. 18–Mar. 9 | Feb. 18–Apr. 9 | Mar. 20–May 9 | Apr. 19–June 8 |
| Jan. 19–Mar. 10 | Feb. 19–Apr. 10 | Mar. 21–May 10 | Apr. 20–June 9 |
| Jan. 20–Mar. 11 | Feb. 20–Apr. 11 | Mar. 22–May 11 | Apr. 21–June 10 |
| Jan. 21–Mar. 12 | Feb. 21–Apr. 12 | Mar. 23–May 12 | Apr. 22–June 11 |
| Jan. 22–Mar. 13 | Feb. 22–Apr. 13 | Mar. 24–May 13 | Apr. 23–June 12 |
| Jan. 23–Mar. 14 | Feb. 23–Apr. 14 | Mar. 25–May 14 | Apr. 24–June 13 |
| Jan. 24–Mar. 15 | Feb. 24–Apr. 15 | Mar. 26–May 15 | Apr. 25–June 14 |
| Jan. 25–Mar. 16 | Feb. 25–Apr. 16 | Mar. 27–May 16 | Apr. 26–June 15 |
| Jan. 26–Mar. 17 | Feb. 26–Apr. 17 | Mar. 28–May 17 | Apr. 27–June 16 |
| Jan. 27–Mar. 18 | Feb. 27–Apr. 18 | Mar. 29–May 18 | Apr. 28–June 17 |
| Jan. 28–Mar. 19 | Feb. 28–Apr. 19 | Mar. 30–May 19 | Apr. 29–June 18 |
| Jan. 29–Mar. 20 | Mar. 1–Apr. 20 | Mar. 31–May 20 | Apr. 30–June 19 |
| Jan. 30–Mar. 21 | Mar. 2–Apr. 21 | Apr. 1–May 21 | |
| Jan. 31–Mar. 22 | | | |

The average length of the profitable reproductive period in a fox is about 10 years. The number of young in a litter varies from 1 to 10, but the average from adult parents is 4. The average number of pups raised at present, however, is about two to the litter.

### MATING.

Hope for increased profits in fox raising lies almost entirely in improving the stock by selective breeding. The better practice has been to mate a dark-silver male (25 per cent or less silver) with a lighter female (25 per cent or more silver) with the expectation that the majority of the pups produced will fall in the dark-silver class. This does not always occur, however, for the reason that the ancestors of the parents may not have been bred along dark-silver lines. On the other hand, if the ancestors as well as the parents have been mated with the aim of producing extra-dark and dark-silver pelts, then the chances are that the offspring from such matings will continue to produce dark silvers.

The chief factor to be borne in mind is the general tendency of each generation of silver foxes to be lighter than that preceding. To overcome this is one of the objects of intelligent breeding. An intimate knowledge of the breeding and pedigree of the ancestors as well as of the parents is required. In selecting pups for breeders it should be remembered that as a rule the pelt becomes lighter with age. For example, a dark-silver pup (see frontispiece) may within a year or two nearly approach the light-silver class. It is not advisable, therefore, for anyone starting in the fox business to purchase for breeding stock animals classed as silver or light silver (75 per cent or more silver). At present, pelts of this class find a ready market at a reasonable return, but they do not have so fine a texture and finish as the darker pelts and therefore do not command so high a price.

A ranch should contain both light and dark silvers, however, for the following reasons: (1) Dark silver animals of approved ancestry are essential for breeding stock because of their known ability to transmit this character; (2) light silvers are desirable because, while the pelts do not now bring so high a price as the dark, they have a quicker turnover; and (3) light silvers should be maintained as a safeguard in case the present preference for dark-silver pelts, which is based largely on fashion, should turn to the lighter strains.

It should be remembered that breeding for prepotency, prolificacy, and disposition are of as much importance as breeding for color. These factors have been given some consideration by a few progressive breeders, but if more thought were given to these points by the average breeder some of the main difficulties now encountered would be overcome.

It is necessary to study as carefully as possible the natures of the two foxes to be mated by watching their actions. It should be remembered, however, that foxes, when aware that they are being observed, do not act naturally. When the foxes to be mated have been finally determined upon, they are placed in a pen together and further observed to determine accurately and quickly whether they will live together peaceably. A decision one way or the other may, in some instances, be reached in a few hours, but again it may take days, or even a week. If the foxes are inclined to get along well together, the breeder may expect a successful outcome. Failure of the breeder properly to choose mates by careful selection and observation may result in the loss of a valuable breeding fox.

The possibilities of modification or improvement by selective breeding are fully as great with foxes as with domesticated animals, and it is only logical to believe that selective breeding will in time produce thoroughly domesticated breeds. Some of the highest-priced fox pelts ever marketed were produced by animals raised in captivity.

## MONOGAMOUS AND POLYGAMOUS MATING.

Monogamy is the mating of one male with one female; polygamy, the mating of one male with two or more females. A beginner should handle and breed foxes in pairs. After he has acquired considerable knowledge and experience it may be found advisable to practice polygamous mating.

Foxes in the wild are said to be monogamous, but it is definitely known that those bred in captivity are both monogamous and polygamous. Ranchers who were aware of the necessity of producing more pups per pair of foxes by lessening the number of shy breeders resorted to polygamous mating as an experiment. Attempts were made to mate one male with several females during one breeding season. As a rule the results have been satisfactory so far as increasing production is concerned. This is true of red, cross, and silver foxes. It is believed, however, that the majority of ranchers practicing polygamous mating are doing so simply with a view to increasing the number of pups, and are not paying particular attention to the individuals to be mated. Polygamous mating should do more than increase production. The vitality and quality of the offspring generally should be much improved as compared with that of the parents. These are factors to be given consideration in making such matings, otherwise the progeny may be of inferior type, thus defeating the primary object—breed improvement.

## ESSENTIALS OF FEEDING.

### PRINCIPLES OF FEEDING.

The same judgment required in the selection of foxes should be exercised in feeding them. Intelligent selection will be ineffective unless the feeding is such that the animals will thrive and yield a good increase. The real object is to supply nutritive material for building and repairing the body and for producing good fur. The ration must be wholesome and acceptable to the foxes, and at the same time it must be reasonably cheap. Cleanliness in preparation and regularity in feeding are important.

To get the best results a feed must be provided that is palatable and acceptable to foxes. The same feeds and combinations of feeds should be used steadily, and sudden changes either in the diet or in the manner of feeding should be avoided. A feed may be satisfactory in certain combinations, but not in others. While it is not meant that the same kinds of feed should be given during every season of the year, the danger is pointed out that foxes may be "thrown off their feed" by such radical changes as occur when one rancher suddenly adopts a new ration on learning of another's success with it.

Fox feeding has not yet advanced to the stage where the effects of all feeds upon the animal's body can be specified, but some are well understood. For instance, mineral matter is necessary to proper growth and is found in all of the vital parts of the body. Young growing animals require larger quantities of it than those full grown; hence care should be taken to provide a liberal supply, especially of calcium and phosphorus. When a ration is deficient in either of these, the calcium may be furnished in the form of calcium carbonate, well-slaked lime, or ground limestone. Both calcium and phosphorus can be provided in the form of precipitated calcium phosphate, bone ash, or very finely ground green bone or rock phosphate. Green bone and bone ash also supply small quantities of other salts needed in animal nutrition.

## KINDS OF FEED.[9]

For maintenance and growth three substances are necessary—proteins, fats, and carbohydrates.

*Proteins.*—Strictly lean meat, from whatever source derived, affords fuel in the form of protein. The leanest meat is fish. From bones gelatine and pure protein are obtained, the latter, however, not in all respects equivalent to that of meat. Milk and eggs are particularly valuable for their protein content. Feeds in the protein class include horse meat, beef, mutton, veal, pork, rabbit, squirrel, chipmunk, woodchuck, chicken, pigeon, various kinds of fish, lobster bodies, packing-house offal (such as hearts' livers, spleens, tripe, tongues, trimmings, and lungs), eggs, milk (whole, separated, condensed, and evaporated), ground alfalfa, oats, wheat, and corn.

*Fats* are found to a greater or lesser extent in all kinds of meat. Feeds classed as fats include milk (especially valuable for its fat), eggs, suet, cracklings, oil meal, and fish meal.

*Carbohydrates* are contained in wheat, oats, corn, and other grains and to some extent in all kinds of fruits and vegetables. Feeds classed as carbohydrates include bread, cracker waste, shredded wheat waste, rice, ground wheat, corn meal, oatmeal, bran, middlings, homemade and manufactured biscuits, apples, raisins, grapes, onions, and carrots.

*Minerals* are most easily supplied in a mixed ration. Feeds containing iron, calcium, and phosphate are milk, dried blood, tankage, fish meal, and ground raw bone. *Water*, while not strictly a food, contains some mineral matter, but its chief functions are to help regulate the concentration of the food elements, making possible the transportation of various materials to the tissues by holding them in solution, and to facilitate the removal of waste through the excretory system.

Aside from the fuel feedstuffs, mineral constituents, and water, there are substances existing in minute quantities in some feeds and not in others that exercise a profound influence on nutrition. Only recently have these been studied, and their exact nature is still under investigation. They are spoken of as *vitamins*, or accessory food substances. Fresh feeds and whole milk, together with some variation from time to time in kinds of feed, will supply these accessories in sufficient quantity for all the elements contributing to good nutrition to be represented.

A ration composed of a variety of feeds will give better results than a very simple fare, even though the latter supplies the proper proportion of proteins, carbohydrates, fats, and minerals. This does not imply changes in the ration from day to day. The meat part of the ration especially should be varied as widely as possible. Some ranchers feed foxes entirely on meat and, to obtain variety, give beef one day, horse meat the next, liver the next, etc. The desired end is not thus attained, for the food constituents are practically the same.

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[9] All the feeds mentioned have been actually fed on ranches in the United States and Canada.

## PREPARATION AND METHODS OF FEEDING.

The preparation of the feed and the method of feeding have a great influence on the breeding of foxes and the production of fine pelts. Only sweet, wholesome, clean feed should be supplied—never putrid or diseased material. A few extra dollars spent to obtain the right kinds of feed may save many hundreds later, for a proper diet and satisfactory methods of feeding are important factors in lessening the chances of outbreaks of disease. The general practice followed on many successful fox ranches is to feed twice a day, morning and evening, the rations varying throughout the week.

On certain days the morning feed may consist of a stew, on others it may be rice combined with milk, and on still others oats with milk. Cracker waste, stale bread, shredded-wheat waste, home-made or manufactured biscuits, each in combination with milk, are used in the same way. Biscuits are also fed alone.

All stews fed to foxes are prepared along one general line, and contain a large variety of food constituents. The meat ordinarily used is beef or veal, and is generally from the bony portions. It is boiled until the meat falls from the bones, and then both the meat and the bones are removed. To the liquor is added the meat, which has been ground, and rice, finely ground wheat, corn, or rolled oats—all these cereals may be used, but one is sufficient. Chopped vegetables, as potatoes and carrots, are added and the whole boiled until the cereals and vegetables are thoroughly cooked. Small portions of ground alfalfa hay, dried blood, ground bone, and salt are then thoroughly mixed in. This forms a reasonably thick stew for feeding to adult foxes. When intended for vixens suckling young or for young foxes milk and eggs should be added and the stew served warm. The relative proportions of the various ingredients are roughly as follows:

| | Per cent. |
|---|---|
| Meat | 40 |
| Cereal | 25 |
| Vegetables | 25 |
| Alfalfa hay, blood, and bone | 10 |

While a number of fox biscuits can be purchased on the market, analyses have shown that the majority are deficient in mineral material. Biscuits prepared according to the following recipe have been used successfully on a number of ranches and are relished by the pups as well as by the adult foxes:

Ground whole wheat, middlings, cracker waste, cracklings, baking powder, and fat rendered from fresh meat are mixed with buttermilk to form a dough. This is placed in pans approximately 10 by 12 inches in size, 1½ inches deep, and then baked in a slow oven 1½ to 2 hours.

These biscuits when thoroughly done are not dry and hard, but are much like cake. They are not fed fresh, but are allowed to stand for a day or two, when they may be given either dry or with milk.

The evening meal consists generally of raw or cooked meat, cut up in small pieces or ground. This lessens the chance that the foxes will drag it into their dens or bury it, thus rendering the pens insanitary. The heads and entrails of rabbits, chipmunks, and other

rodents frequently contain parasites, and for this reason should not be used. The pelts of these animals also should be removed. Opinions among breeders differ as to the relative merits of cooked and raw meat, but all agree that on the whole fox ranchers have been feeding too much meat.

All feed should be given in dishes, preferably of aluminum or earthenware. Under no circumstances should it be thrown on the ground, as such practice renders it practically impossible to keep the pens and dens sanitary. Bones thrown in the pens for the foxes to gnaw should be removed frequently. (See Fig. 39.)

Fresh clean water should be accessible to the foxes at all times, and even during freezing weather it should be supplied at frequent intervals.

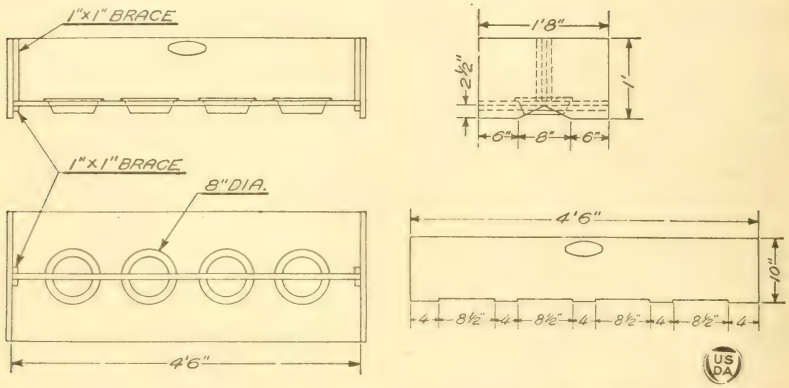


FIG. 39.—Satisfactory and convenient device for feeding pups after weaning. The vertical sliding board holds the dishes in place and also serves to separate the pups feeding from either side.

## AMOUNT AND FREQUENCY OF FEEDING.

The amount of feed supplied depends entirely on the season of the year and the age, appetite, and condition of the fox. Adult foxes should be fed fairly heavily just before and during the breeding season, so that they will be in good vigorous condition. Some breeders believe that heavy feeding of vixens prior to this season will bring on the heat period quicker and increase the chance of conception. Forced feeding has a tendency to make the fur prime sooner than it would be naturally, but the advisability of practicing this is questionable, because in many cases the fur thus becomes prime before the skin.

Vixens suckling young, and pups that have been weaned, should be fed liberally. As a rule, during the summer mature foxes should be fed sparingly, but if a vixen is run down she should be given sufficient to bring her back to a good thrifty condition. In the majority of cases, however, foxes are being given too much feed at all seasons of the year. The appetite is a good index to feeding, and the amount of feed supplied should be regulated so that the fox

will remain active and show eagerness to eat at meal time. It should clean up its feed within 20 minutes and all feed containers should be collected one hour after feeding, anything remaining in the dishes being destroyed. The amount of feed left in its dish will determine whether a particular animal should receive a full portion at the next meal.

During freezing weather it is almost impossible to maintain an adequate water supply in the pens, and stews are apt to freeze before the foxes can eat them. Every effort should be made to overcome these difficulties by the use of the homemade biscuits previously mentioned. Milk is easily provided in winter, as foxes will lick it from the pans even though it is frozen.

Accurate information as to the feed requirements of a ranch fox for normal development and reproduction is needed, and to obtain it experiments are being conducted by the Honorary Advisory Council for Scientific and Industrial Research, Ottawa, Canada, and a preliminary report has been made thereon by G. Ennis Smith.[10] The substance of his report is contained in the following paragraphs:

While it is not feasible to draw definite conclusions from experiments of a single season and on a limited number of foxes, the influence of certain factors is sufficiently apparent to warrant preliminary recommendations regarding rations. Experiments have been conducted with foxes 2 years old or older and the recommendations, therefore, would not apply to yearlings.

The results thus far obtained tend to indicate that continued overfeeding should be avoided, and that so far as quantity goes the most suitable ration for a ranch fox is one just a little in excess of the minimum required to maintain body weight. Only one period has been found when it is advisable to feed larger quantities to adult foxes, and that is to the female when she is suckling young. Healthy foxes are seldom indifferent to feed except during the breeding season, and, generally speaking, the appetite does not become normal until this season is over. When foxes refuse to eat it is better to give only one feeding a day until they regain their appetite. It is not necessary to have them in too good flesh during the breeding season, but simply in vigorous condition. Fat animals are sluggish and will not breed.

Failure to raise a large majority of the pups whelped is due largely to improperly feeding the vixen during pregnancy, and this may also result in rickety pups. Rickets may also be caused by a restricted ration or one deficient in protein, mineral material, or other food accessories. It should be borne in mind that during pregnancy the vixen is doing the double duty of keeping up her own bodily functions and providing for the development of the litter. The feeding should be liberal, although not so heavy as after the pups are whelped.

Experiments show that in foxes generally, a well-selected ration only slightly above the minimum required to maintain body weight is sufficient to meet the requirements of the pregnant vixen, and that it is very favorable for reproduction. During the experiments the foxes fed such rations were eager for their meals, ate at once, were alert, and appeared to take a great deal of exercise.

For the guidance of fox ranchers the following rations are suggested by Mr. Smith in his report above referred to, Nos. 1, 2, 3, and 4 being recommended chiefly for use during the breeding and gestation periods.

[10] Rept. No. 9, Food Requirements of the Ranch Fox, Ottawa, 1921.

TABLE 2.—*Specimen rations for foxes.*

| Ration. | For 10-pound fox. | For 12-pound fox. |
|---|---|---|
| No. 1: | | |
| Fat meat or offal | 5½ ounces | 6½ ounces. |
| Fox biscuits | 1⅛ ounces | 1⅓ ounces. |
| Milk | ⅗ pint | ⅔ pint. |
| No. 2: | | |
| Lean meat or offal | 8 ounces | 9½ ounces. |
| Smelts or herring | 8 ounces | 9½ ounces. |
| Milk | ⅗ pint | ⅔ pint. |
| No. 3: | | |
| Liver (lamb's) | 4¾ ounces | 5¾ ounces. |
| Fox biscuits | 1⅛ ounces | 1⅓ ounces. |
| Milk | ⅗ pint | ⅔ pint. |
| No. 4: | | |
| Lean meat or offal | 8 ounces | 9½ ounces. |
| Beef suet | ½ ounce | ⅔ ounce. |
| Milk | ⅗ pint | ⅔ pint. |
| No. 5: | | |
| Lean meat or offal | 4 ounces | 4⅞ ounces. |
| Cereals, cooked | 2¼ ounces [1] | 2⅔ ounces.[1] |
| Milk | ⅗ pint | ⅔ pint. |
| No. 6: | | |
| Cereals, cooked | 2½ ounces [1] | 2⅔ ounces.[1] |
| Cod liver oil | ½ ounce | ⅔ ounce. |
| Milk | ⅗ pint | ⅔ pint. |
| No. 7: | | |
| Smelts or herring | 8 ounces | 9½ ounces. |
| Cereals, cooked | 2½ ounces [1] | 2⅔ ounces.[1] |
| Milk | ⅗ pint | ⅔ pint. |

[1] Dry weight.

As the period of whelping approaches, the vixen should be fed principally mushy feeds in limited quantity and have access to fresh water at all times. It is advisable to eliminate meat a week before whelping, with the exception of liver and tripe, which may be fed two or three times during that week. After the pups are whelped great care must be taken to feed the mother properly if she is to raise them successfully. Mineral matter is particularly needed, and to furnish it the ration should be supplemented with bone meal, fish meal, or edible tankage. For the first three or four days the feeding should be light, and then it should be increased gradually until the vixen is on full feed, at about the end of a week or 10 days, depending upon the size and thrift of the litter. To meet the requirements of a vixen with four pups Mr. Smith suggested the rations shown in table 3:

TABLE 3.—*Ration for vixen with four pups.*

| Daily rations. | First week. | Second week. | Third and fourth weeks. |
|---|---|---|---|
| Milk | ¾ pint | ¾ pint | 1 pint. |
| Meat | 8 ounces | 12 ounces | 12 ounces. |
| Biscuits | 1½ ounces | ..... | ..... |
| Cereal as porridge | ..... | 2 ounces. [1] | 3 ounces. [1] |
| Egg | 1 | 1 | 1 |

[1] Dry weight.

When the pups are about 4 weeks old the vixen begins to carry meat to them, and it is therefore advisable to eliminate meat from the ration at this time, feeding only cereals, vegetables, and milk.

Rations composed of such feed make the feces very bulky, and to counteract this cod-liver oil and eggs may be added.

Breeders differ in opinion as to whether pups should be separated from the mother at a certain age or be allowed to wean themselves. After the young reach the age of 8 weeks both they and their mother can be handled to better advantage if fed separately. Size and development determine the weaning age.

The pups' feed should be varied as much as possible; that is, it should not be restricted to one cereal or one kind of meat. Beef should form a large part of the ration, as this in itself is a fairly well balanced feed. Bone meal, fish meal, and edible tankage should be added to insure a supply of lime. Limewater is of no value to offset a deficiency of lime in the ration, but in counteracting acidity of the stomach is an aid to digestion. Freshly formed clabber is a good feed for young pups once or twice a week.

The rations shown in Table 4 have been used successfully on the Canadian Experimental Fox Ranch at Hull, Quebec, as reported by Mr. Smith, the pups raised on this feed showing no sign of rickets and maintaining uniform growth and developing good fur.

TABLE 4.—*Suggested rations for pups up to the age of 5 months.*

| Kind of feed. | Amount per pup, at the age of— | | | | |
|---|---|---|---|---|---|
| | 2 months. | 2½ months. | 3 months. | 4 months. | 5 months. |
| Milk.....pint.. | ⅜ | ½ | ½ | ½ | ½ |
| Cereals, cooked [1].ounces.. | 1 | 1½ | 1½ | 2 | 2 |
| Bread.....do... | 1 | 1 | 1 | ..... | ..... |
| Meat, ground..do... | 1 | 2 | ..... | ..... | ..... |
| Meat.....do... | ..... | ..... | 4 | 6 | 8 |
| Fat or oil.....do... | ..... | ..... | ½ | 1 | 1 |
| Egg.....do... | ½ | ½ | ½ | ½ | ½ |

[1] Dry weight.

## VIXENS EATING THEIR YOUNG.

Cannibalism among foxes is not natural, and the vixen's desire to destroy her young may result from any of a number of causes. If constipated, she becomes feverish and develops an abnormal appetite, and in this condition may eat her pups. To prevent this, laxative feeds, as cod-liver oil, eggs, liver, oil meal, and biscuits, should be fed during pregnancy. Undue excitement or injury during pregnancy may also influence destruction of the young. Some breeders have advocated the feeding of salt pork and salt fish to eliminate this tendency, but this is not always successful. It is not advisable to destroy a valuable vixen because she eats her first litter, but in case she continues the practice with subsequent litters her pelt should be taken during the prime season.

## GENERAL MANAGEMENT.

Successful fox farming requires good management in the organization of the ranch, selection of stock, feeding, and breeding, combined

with an intimate knowledge of the characteristics and behavior of the fox in captivity.

## THE RANCHER.

Many of the failures in fox ranching may be attributed directly to carelessness and negligence on the part of the rancher. Foxes will not do well under shiftless management, and a caretaker who has no interest in the welfare of his foxes need not expect success. The rancher should handle his breeding foxes in a manner to insure the highest percentage of increase and should be willing to sit up part of the night watching their actions. One who walks through the ranch without the keen perception to detect a sick fox is by no means the right type of caretaker, and one who sees the sick fox but does not care for it at once is even worse. A rancher who likes to be away from his foxes as much as possible has not the thrift and

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FIG. 40.—Foxes appreciate kindness and respond to good treatment on the part of the keeper.

welfare of the ranch at heart, and a caretaker who is not disturbed over the loss of a pup should no longer have charge of a ranch. One who is not careful to avoid feeding moldy or spoiled feed of any kind is not a true rancher. He must not share the opinion of some men that foxes need little or no water, but must supply them with fresh, pure water every day, for foxes require water just as much as any other animal. If he allows them to drink old, stagnant water, he runs the risk of having them infested with all sorts of parasites. If a rancher fits foxes and goes into the show ring simply to be there among other ranchers and is not possessed of a strong desire to win the best prizes offered, he had better stay at home and save time and money.

A good faithful rancher looks to every detail of his work and has his mind and heart with his foxes at all times. He leaves nothing undone to promote the thrift and welfare of each individual fox. He likes to talk with successful ranchers about foxes, and tries to learn about improved methods of handling and manage-

ment. (Fig. 40.) The readiness with which his foxes accommodate themselves to a life of captivity depends greatly upon his attitude toward them.

## BEHAVIOR OF FOXES IN CAPTIVITY.

Before one can intelligently handle foxes he must know something concerning their behavior. He must study them at every opportunity, whether performing his duties on the ranch or observing foxes from the watch tower. As previously stated, the instant a fox becomes aware that it is observed it changes its behavior entirely.

Foxes are naturally active at night but quiet during the day, remaining in the den, curled up on top of the den, or in some shady, secluded spot. They are inquisitive, and their desire to see everything that is going on around them leads them to select advantageous positions for the purpose. (Fig. 41.) Moving objects inter-

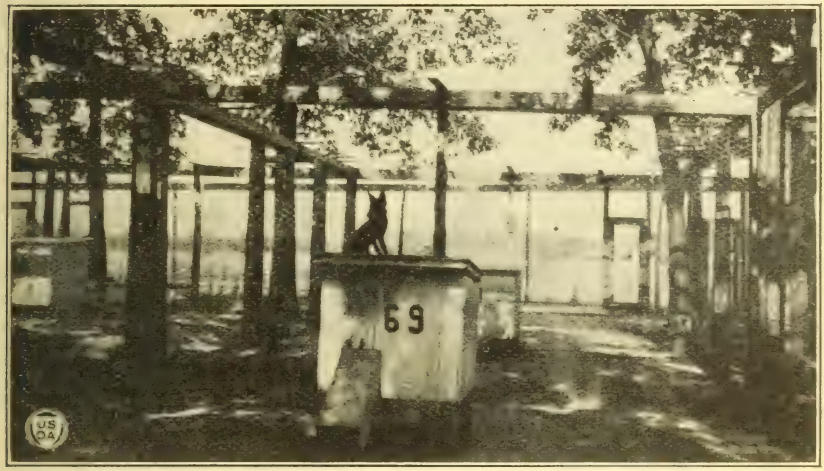


FIG. 41.—On the lookout. Under proper management foxes soon display a lively interest in their surroundings.

est them keenly, and birds or mammals entering their pens fall quick prey to their alertness. As a rule they live peaceably together, but their treacherous disposition becomes apparent when they can take a mate or a neighbor at a disadvantage.

The natural instinct of foxes to burrow in the soil seems to be exaggerated in some individuals, and when suddenly frightened they try to escape in this way or by climbing the walls of the pen.

Excitability is one of the most troublesome traits of foxes, although it is believed that too much stress has been placed on this. It is not intended to convey the idea that they do not need quiet or that unnecessary causes of excitement should not be avoided; on the contrary, the breeder should take advantage of every occasion to allay their suspicions and gain their confidence. As a rule foxes are suspicious of strangers and on the approach of a newcomer frequently sound a warning call and run to cover. On some ranches this is not the case, and it is believed that lack of fear is due largely to the method of handling and feeding. It is an established fact

that the number of pups whelped and raised to maturity on ranches where the policy is followed of leaving the foxes to themselves as much as possible is far less than the number raised by ranchers who handle the foxes with the same good judgment used in managing domestic stock.

Foxes, like other animals, possess a variety of dispositions and temperaments. No two pairs are exactly alike, and each pair should receive individual consideration. To study their traits and peculiarities should be one of the primary objects of the caretaker, and his success is determined largely by the use of his wisdom against the cunning of the foxes.

## THE BREEDING SEASON.

Before the foxes have been selected for mating and placed in their respective pens, the yards should be thoroughly cleaned, the dens scrubbed with hot water and soap, and sprayed with disinfectant or burned out with a blow torch, and the nest boxes cleaned and put in place. Foxes usually prefer no bedding material, but on some ranches have become accustomed to straw.

As the breeding season approaches, the foxes should be kept as quiet as possible and, as a rule, strangers should not be allowed to enter the ranch, although this precaution may be left to the judgment of the caretaker.

A shy fox may never appear at feeding time, hence the mate will gobble up all the feed. Where this occurs feed for the shy fox should be placed inside the den. When one is a bully and drives the other away from the feed, it will be necessary to separate the containers as widely as possible. It is well for the keeper to have a call and to talk to the foxes at feeding time, so that they will become accustomed to him. All matings observed should be recorded, and it is desirable that the rancher spend a large portion of his time in the watch tower getting this information.

After the foxes have been seen to breed the dog should be separated as soon as possible and placed in the quarters built for the purpose. While a dog may be as devoted to the pups as is the vixen, the care he may give the young is more than counterbalanced by the harm he may do to his mate. Dogs have a tendency to injure the pups by carrying them in and out of the dens, and often kill them by fighting. The separation of the dog and vixen eliminates the possibility of loss from these causes.

## PREGNANCY.

Special care and attention should be given the vixen during the period of pregnancy. Undue excitement on the ranch during the advanced stages may cause abortion (premature birth), especially among the very nervous and excitable vixens. It may be well to mention again that the feed should be of a soft nature and should contain nothing constipating. In the case of a shy vixen that will not leave the den to eat, the feed should be placed in the outside chamber of the den. This will enable her to eat before the feed freezes and will also accustom her to the presence of the caretaker every day. The caretaker, however, should make sure that the vixen

is really shy and is not lying in the den because she is overfed and too sluggish to come out. If the latter is the case, feed should not be given until she appears hungry. If vixens are properly handled and fed during this period there should be no trouble during whelping.

## WHELPING.

On account of the many disadvantages connected with the practice, it is rare indeed that a vixen is permitted to follow her natural instinct to whelp her litter in a hole which she digs in the ground. Aside from the fact that this fosters a wild trait which it is one of the objects of domestication to modify, it frequently endangers the lives of the pups, for if the soil is not well drained a heavy rain may result in drowning them. Another disadvantage is the difficulty of digging out the vixen and pups if for any reason it becomes necessary to treat them. Success with this method of whelping is the result of good luck, not good management.

During the entire whelping period the vixen should be undisturbed. The pen should be entered only to give her feed and water or for some other absolutely necessary reason.

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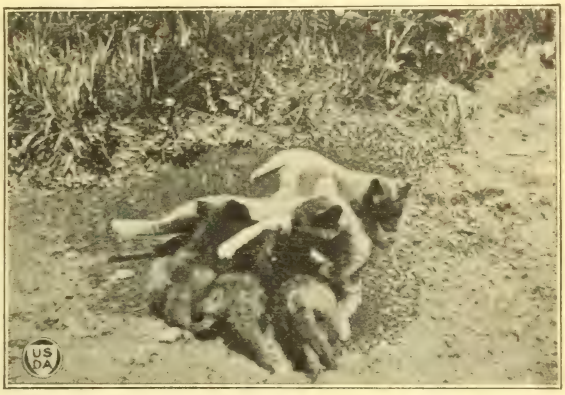

FIG. 42.—The cat may be used as a foster mother in emergencies, but she must be free from parasites.

## LACTATION.

After the pups are whelped the feed should be increased gradually. Methods have been fully described under "Feeding." The use of the double-box den simplifies matters considerably at this time. The feed can be placed in the outer box, and when the caretaker hears the vixen leave the den to feed he can lift the cover of the other box to examine the litter and remove any dead pups. No bad results will occur if the keeper is careful.

Vixens, especially young ones, sometimes fail to produce enough milk to nourish the pups. If such is the case, or if the vixen dies, a cat may be used as foster mother, but this practice should be followed only in an emergency. (Fig. 42.) The rancher should be sure that the cat is free from parasites before she is so used.

## WEANING.

When the pups are about 8 weeks old they should be taken from the mother and placed in new, clean quarters. There has been a great drain on the mother's system during lactation, and this gives her a chance to recuperate. Another reason for this separation is

to prevent a tendency on the part of the pups to become wild, caused by a nervous excitable vixen, for at the least provocation such a mother sounds a warning call and the pups scamper into the den, sometimes injuring themselves in their haste.

Separation from the mother also facilitates the proper feeding of the young. Twice a day is often enough to feed them. In the case of backward pups a little cow's milk can be given as a noon feed. Those showing a disinclination to eat and failing to grow should be removed to another pen and placed under observation to determine the cause. Careful feeding is very essential to the satisfactory development of the pups. More pups can be raised to maturity if weaned and fed separately than if permitted to remain with the mother (see Fig. 39, p. 42).

## HANDLING.

It is believed by many ranchers that the only time foxes should be handled is when they appear to be injured or diseased. As a matter of fact, they should be handled much more frequently. Final judgment on a mating should not be based on superficial observation. The foxes should be handled and examined closely to determine their general make-up and the quality of their fur. As many points as practicable should be observed during one examination. For instance, the ears should be inspected for mange mites, and the back of the ears and fore and hind flanks, which are tender portions of the fox's body, for parasites. It is usually necessary to handle the foxes frequently late in summer and early in fall for the purpose of exhibiting to prospective buyers the quality of the animals on the ranch as well as the color and quality of fur. There was a time when foxes could be sold without close examination, but the buyer of to-day is able to exercise more discrimination and insists upon knowing what he is purchasing.

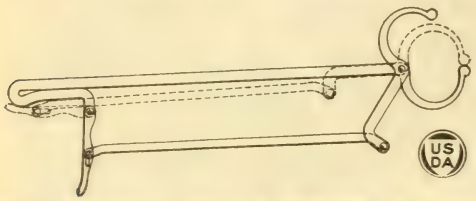

FIG. 43.—Diagram showing operation of fox tongs.

Although few expert ranchers use gloves when handling foxes, it is well for the beginner to do so. He should also use tongs in capturing the animals, such as those illustrated in Figure 43.

When the caretaker enters the pen for the purpose of catching a fox, the animals invariably run into the den. He then lowers the slide of the chute, thus shutting them in, and slightly raises the cover of the den to permit the insertion of the tongs. The fox is grasped around the neck, and then, the tongs being held with one hand and the hind legs and tail of the fox with the other, the examination can be made.

When it is desired to transfer a fox from one pen to another, or to remove it temporarily for treatment, a small handling box, such as shown in Figure 44, may be used. This is made of 1-inch material 32 inches long, 8 inches wide, and 9 inches high. The top board is hinged and fine-mesh wire nailed to the box under the cover to per-

mit examination. At one end is a slide door and at the other a hinged wire door provided with a hook-and-eye fastening. The top cover may be held down by a bolt and lock or by a snap and hinge, as illustrated in the figure. A strap handle is attached to the cover for convenience in carrying.

## TRANSPORTING.

Foxes in good condition can be shipped almost any distance, but if the journey is long or the shipment large it will be well to have an attendant go along to feed and care for them. Foxes can go without feed for two or three days with no apparent ill effects. In transit they have a tendency to lose their appetites, and should be fed carefully, although fresh water should always be supplied. Small pieces of meat, preferably liver or beef, and fox biscuit may be given.

It is not advisable to place more than one fox in a compartment of a shipping crate. A crate containing two compartments, each

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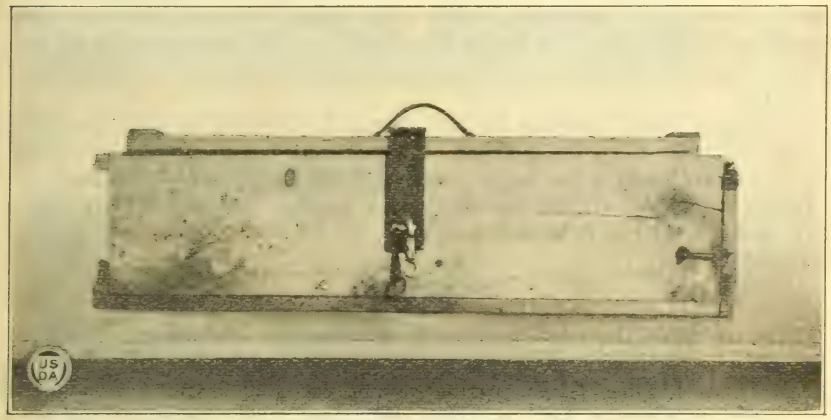

FIG. 44.—Convenient transfer box for handling foxes; it is made of 1-inch boards and may be 32 inches long, 8 inches wide, and 9 inches high.

2 feet high and having a floor space of approximately 2 by 3 feet, is large enough to carry a pair of foxes. It should be made of wood, with the exception of the door, which should be of wire. Some ranchers entirely cover the crate with wire to prevent escape of the animals. In the front of each compartment dishes for feed and water should be fastened where they can be filled from the outside.

## CULLING.

Every fall before the breeding season begins the old foxes as well as the pups should be carefully culled and the best ones retained to improve the stock. This is necessary to maintain the quality of the foxes on the ranch, old, unserviceable animals being replaced by young, vigorous stock. The following classes should be culled: Vixens that have not proved to be profitable producers, old foxes that have served their term of usefulness, samson foxes (see p. 33), and foxes carrying pelts that are tinged or otherwise inferior.

The final judgment of the caretaker as to which foxes are to be retained should be based on the records kept of the performance of individual animals. A ranch owner who inspects the foxes only at intervals is apt to judge the animals on the basis of appearance rather than performance, and for this reason selection of the foxes to be retained should be left entirely to the resident caretaker, who has had opportunity to study the individuals and to become familiar with the characteristics of each.

The foxes to be disposed of should be separated and fed sufficiently to maintain good health. The pelts of fat foxes, however, lack sheen and finish because of the tendency of the animals to lie around and not take sufficient exercise. In order to improve the quality of the fur it is a good plan to shut the foxes out of their pens on cold days in winter, not, however, during wet or inclement weather.

## PELTING.

The business of fox raising is based on pelt value. Many of the most successful ranch owners follow the practice of killing some foxes every year and marketing the pelts. These are naturally the culls—that is, the old foxes that have served their period of usefulness, nonproducers, and those that have been injured through accident.

It is not a good practice to pelt pups, as their skins lack finish in the fur as well as in the leather. Occasionally a pup skin of exceptional development sells for a good price, but this is not the rule. It is better for the rancher to carry the young over until they are a year and a half old or older and the pelt has developed into a more marketable skin.

### PRIMENESS.

Pelts of foxes become prime in November, December, January, and February, depending upon the season, climate, and feeding. In the United States the majority of pelts become prime in December and January, with a few in February, the exact time varying with the individual. Primeness is the highest quality of perfection in a pelt; when the pelt shows quality and finish, determined by its texture and sheen, it is said to be prime.

Ability to judge primeness comes only through experience. When the fur is coming prime it does so rapidly, and after it reaches the peak of perfection it soon becomes overprime, losing its sheen and finish. It therefore behooves the rancher to watch closely day by day each individual set aside for pelting.

It is better to take the pelt just before it is prime than to take the chance of delaying until it is overprime. This is one of the periods when frequent handling is necessary.

### KILLING.

In killing a fox the method generally pursued is as follows: The animal is caught with the tongs, taken to the killing shed, and laid on its side. The caretaker then places his foot on its chest and crushes out the life. This practice has been followed because it does not injure the pelt. Striking the fox on the back of the head with a club leaves a blood clot on the pelt and sometimes cuts it.

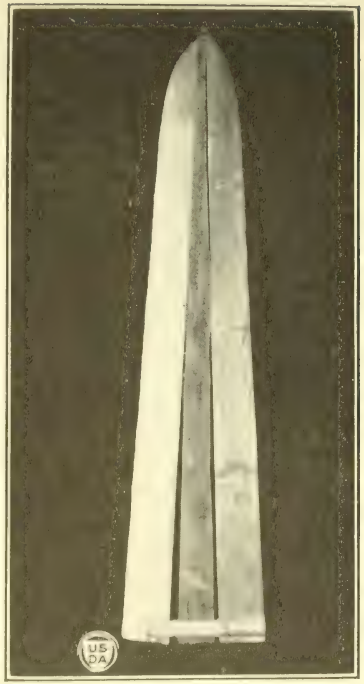

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FIG. 1.—FRAME FOR DRYING PELTS.

Instead of middle wedge some frames are made in one piece and serve the purpose equally well.

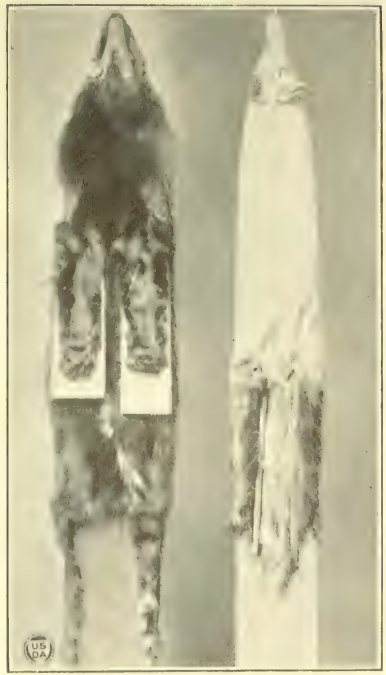

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FIG. 2.—PELTS ON DRYING FRAME.

Illustrating the proper method of thoroughly drying the legs and brush.

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PELTS READY FOR THE RAW-FUR MARKET.

When the drying and cleaning processes are completed, the finished product well repays the rancher for the care taken in all the stages of management.

A more humane and satisfactory method of killing is by the injection of a solution of strychnine sulphate. Objection has been made to this on the ground that strychnine may injure the pelt by causing the hair to fall out. This, however, is not the case. The effect, if any, of strychnine on the hair follicles is contracting rather than relaxing. In any event there would be no ill effect in the case of foxes in captivity, since the pelt is removed so soon after death.

The operation of injecting strychnine sulphate is very simple. The instruments used are a small hypodermic barrel syringe, two reasonably long needles, and a quantity of a 3 per cent solution of strychnine sulphate. The syringe is filled with the solution and the gauge set for 1 cubic centimeter. The fox is placed on its right side and held by an attendant. The operator places his hand on the chest to locate the heart, at the same time feeling for a space between the ribs to avoid running the needle into the bone. The needle is inserted in the direction of the heart and the dose discharged. In less than a minute the fox dies without a struggle.

## SKINNING.

After the animal heat goes out of the body the flesh shrinks from the skin, permitting the pelt to be removed more easily and keeping the skin side free from blood. This will take place in about half an hour, but in this period care should be taken to prevent the carcass from freezing.

The only tool needed in skinning a fox is a pocket knife, and this should be kept sharp during the operation. A slit is made up the back of each hind leg, starting at the inside of the paw and running to the hock, then from the hock to a point just below the root of the tail. The back of each front leg is slit in the same manner from the paw to the first joint. The skin is then worked free from the flesh from the first joint to the claws, and the bones of the claws are cut free from the pelt, but the nails are allowed to remain with the fur. A slit is made from the root of the tail about half its length and all of the bones are pulled out of the brush.

The carcass is then hung on a hook or nail by the tendon of the hock joint and the pelt is pulled down, the knife being used whenever necessary to free it, until it is removed as far as the neck. The knife is then used, and careful work is necessary to cut around the base of the ears, including them in the pelt, then around the eyes, and around the mouth and lips. Carcasses should be disposed of immediately by burning.

## DRYING PELTS.

The pelt is placed on a wooden frame for drying as soon as it is taken from the carcass. (Pl. III, Fig. 1.) The frame may be made of soft wood one-half to five-eighths inch thick. Soft material will facilitate drying and the drawing of tacks. A board 45 inches long and approximately 7 inches wide should be used, rounding out a nose at one end. At a distance of 12 inches from the nose the board should be 6 inches wide, and at the base 7 inches. Cut the board in halves, lengthwise, and on the sides of one of the pieces fasten two straight strips at right angles at the base, so that when the

frame is inserted into a pelt and a wedge is forced in to stretch it tight there will be no overlapping of the boards. By varying the size of the wedge this device may be used for pelts of different sizes. No more stretching should be done than is required to bring the skin into natural shape. Undue stretching detracts from the value of the pelt. To allow the skin to dry the hind legs and tail are fastened to the frame, by means of small strips of wood and tacks, and the front legs are tacked to small pieces of wood, as illustrated in Plate III, Figure 2.

A tablespoon is used as a scraper to flesh the skin and remove any excess fat. Scraping should not be so close as to remove not only all of the fat but part of the membrane also, for this will cause the skin to shrink from the roots of the guard hairs, permitting them to be pulled out, thus limiting the life of the pelt. Fur buyers look for this defect, and skins having it are severely cut in price.

After the skin has been fleshed and dried on the frame for a day or so it may be taken off, turned fur side out, and immediately replaced. After another day or two it should be again removed and hung on a rope to finish drying. The drying takes about four or five days, and should not be hurried by placing the skin near artificial heat, as this has a tendency to injure it.

After the skin is thoroughly dry it is shaken vigorously and worked with the hand to make it pliable. It is then brushed with a stiff brush and rubbed with burlap to remove all foreign material. A comb may be used, if necessary, to remove dead hairs. All cleaning is done by hand and no chemicals should be applied to the pelt. Frequent handling and brushing at this time does not injure the pelt, but rather puts it in better condition for the raw-fur market.

## CHARACTERISTICS OF A GOOD PELT.

In general, the main thing to be kept in mind in judging a silver fox pelt is quality, and this is affected by many factors. First, the pelt must be prime. This is determined by examining the skin side, which, if the pelt is fresh, should be fairly white or cream-colored and show some "life" when handled. The skin of a fox pelt turns yellow with age and loses its firmness. The fur side should be perfectly and evenly furred all over, both on the back and on the belly, with the fur reasonably long, lustrous, and silky. The brush should be sufficiently long to maintain a balance with the rest of the pelt and should carry a white tip 2 to 4 inches long. There should be no rubbed spots or defects.

Clearness of color is the second factor determining the quality of a pelt. Whether the pelt is classed as black, extra dark, dark silver, or pale, it must be bright and clear in its color phase, that is, there should be no tinge or rust to give the characteristic chocolate or brownish cast. Careful fur buyers make a greater cut in the price of a pelt having a rust or tinge than for any other defect. As a rule, more is paid for a clear, bright-colored pelt that is not so well furred than for a well-furred skin that has a brownish or faded appearance.

Size is the last consideration in valuing a pelt. A difference of 3, 4, or 5 inches in size does not reduce the value of a skin, provided it has the right quality. An extra-large pelt is not desirable, for the principal reason that it is not becoming to the average wearer.

Quality being equal, extra-dark (not more than 10 per cent silver) or dark (15 to 25 per cent silver) skins are the most popular on the market to-day and bring the highest prices. (Pls. I and IV.)

## SANITATION.

The greatest obstacles that ranchers have to overcome in the fox industry are losses through disease—caused mainly by infestation, especially of the young, with parasites. Were it not for the fecundity of foxes their profitable production in the face of present heavy losses from diseases and parasites would be out of the question.

Sanitation is most essential to success in fox raising. In the following remarks no attempt is made to go into the details of diseases of foxes or their treatment, but attention is merely called to the simple measures which may be used by any rancher to avoid to a large extent the losses of foxes in enzootics. Not only are cleanliness and rational methods of management relied upon by ranchers to keep their foxes in health and vigor, but they are the marks of a good rancher and a successful fox raiser.

### DISEASES.

Distemper and other like diseases, characterized by pneumonia, are highly fatal and may be regarded as identical in character, so far as the practical management of the ranch is concerned. Specific diagnoses of these diseases can be made only by the most careful pathological examinations and by the assistance of a fully equipped laboratory. However, prophylactic measures found to be beneficial with any one of these diseases will prove efficacious with all. A rancher must remember that contagious and infectious diseases are caused by specific germs (bacteria and protozoans) and by parasites, and that contagion and infection can not be spread from one animal to another or from one ranch to another except through the agency of these organisms.

Germ diseases and parasites may be carried in a multitude of ways—by the foxes themselves, on the clothing of persons, on vehicles, in feed, or by birds, dogs, and other animals. Following improper breeding and feeding methods does not necessarily cause disease, but careless methods may so weaken the constitution and vitality of an animal that it becomes more susceptible to disease than would otherwise be the case.

Since infectious diseases can arise only through the presence of specific causative agents, it can readily be seen that prevention is very necessary. It should be constantly borne in mind that diseases caused by germs may be best prevented or controlled by thorough disinfection and scrupulous cleanliness.

Many outbreaks of disease on fox ranches have been caused by infected feeds. Feed poisoning has been responsible for losses among old as well as young foxes. The preventive for this is to give clean, wholesome feed and to use clean methods in preparing as well as in feeding it. Some of the troubles which may be attributed to a nutritional defect of some sort are rickets, convulsions, sore eyes, abortion, abandoning young or killing young by vixen, premature cessation or insufficiency of milk supply, failure to reproduce, and imper-

fect development of fur. Proper feeding is essential to a building up of resistance against disease attacks. The thorough cooking of meat, fish, and offal is an important measure in preventing infection with many kinds of bacteria, and of various parasites, such as tapeworms.

## PARASITES.

The chief parasites that affect foxes are hookworms, ascarids, lung worms, tapeworms, coccidia, and mange mites. Sanitation is just as essential in preventing parasitic diseases as those of bacterial or protozoan origin. The droppings of foxes should be frequently and thoroughly removed from the dens and pens, since they carry the parasite eggs. As previously pointed out, good drainage is necessary in the pens and dens, as dryness is unfavorable to parasites and other harmful organisms.

Young foxes are very susceptible to disease and should be given the cleanest possible surroundings in order that they may develop and attain the relative immunity afforded by maturity.

## PREVENTIVE MEASURES.

In maintaining the health of foxes preventive measures against disease must be chiefly relied upon. Dry, well-ventilated quarters are a prime essential, and these must be kept clean. Foxes are naturally clean animals and can not thrive in insanitary quarters.

In addition to cleanliness in pens and dens, close attention should be given to the feed and methods of feeding. Nothing should be fed that will convey disease organisms. Animals that have died from disease should not be fed to foxes unless the meat can be made safe by thorough cooking.

Feeding and drinking dishes should be clean, and the water supplied should be pure and fresh. After each feeding all dishes should be thoroughly cleaned and then boiled.

Holes in the pen soil should be drained and filled up as often as necessary. Wherever possible the surface soil should be scraped off periodically and replaced with clean soil. It would be well to spade up and turn over the soil, stirring it up with a rake to permit the sun to purify it. At least once a month during seasons when it is possible the quarters should be disinfected with air-slaked lime or a 5 per cent solution of some effective coal-tar disinfectant. These precautions will be found a valuable aid in the control of various animal parasites as well as a protection from other serious troubles.

New stock should be quarantined and examined for infection of any kind, and if necessary treated before being placed with clean animals or on clean areas. Sick animals should always be isolated at once to prevent the spread of disease. Foxes returning from shows or from neighboring ranches should be kept separate from the other animals for at least three weeks. If they have been exposed to any disease, it will usually be apparent in that time.

If disease breaks out in the neighborhood, the rancher should maintain a strict quarantine against it. Dogs, cats, rats, and birds, as well as people, may carry infection from ranch to ranch, and this should be remembered and visiting discouraged and trespassing prevented so far as possible.

## TREATMENT OF DISEASE.

Sanitation and the prevention of disease is a function of the fox rancher, but for the treatment of disease the services of a competent veterinarian or specialist should be obtained. The diagnosis of disease and the administration of potent drugs call for special training and experience, and the fox rancher who undertakes unaided the rôle of veterinarian is apt to come to grief.

As soon as sickness appears on a ranch it is always advisable to employ a competent veterinarian. Infected foxes should be removed at once to clean and repeatedly disinfected quarters, preferably small pens (see p. 19, "Hospital and temporary pens"). The diet should be carefully regulated and should include milk and some cooked feed. The pens and dens in which the disease appeared should be thoroughly cleansed and disinfected, using air-slaked lime on the ground and one of the effective coal-tar disinfectants as a spray in the dens and nest boxes. Foxes should not be returned to these pens until it is reasonably certain that they are free from disease-producing organisms.

Care should be taken to maintain a strict quarantine over diseased foxes, and the same attendant should not feed and care for both sick and healthy animals. Watch dogs should be confined until disease is stamped out, and dead animals should be burned at once or buried deep in the ground.

Insanitary conditions cause a large percentage of young foxes to become heavily infested with parasites. Pups as a rule do not leave the den until 3 or 4 weeks of age and they often pick up infestation in the den itself. This indicates either that the eggs or larvae of insects are widely scattered over the pens and dens or that the parents themselves are infested.

Fox ranchers have so universally accepted the idea that all pups have worms that it is a common practice to treat all that are between 3 and 4 weeks old for worms, whether this is necessary or not. In many instances it is necessary, although promiscuous dosing is a very bad practice, for young foxes often do not recover from the shock of the treatment. If proper precautions are taken to prevent infestation by treating the old foxes prior to the mating season and then placing the pups in clean surroundings for the first few months, the young ones will not be so liable to infestation, and treatment could be delayed until weaning time.

Treatment for the removal of ascarids from foxes consists of the administration of a mixture of 1 part of oil of chenopodium and 21 parts of castor oil at the rate of 1 cubic centimeter of the mixture per pound of weight, the dose being given to an animal that has fasted from 6 to 18 hours.

For the removal of hookworms from foxes the treatment consists of the administration of chemically pure carbon tetrachloride in soft elastic globules at the rate of one-half cubic centimeter per 5 pounds of weight, the drug being given to animals that have fasted from 12 to 18 hours.

Because all effective anthelmintic drugs are potent poisons, they should never be used except by a competent veterinarian skilled in small-animal practice.

## RECORDS.

On every ranch handling pure-bred foxes it is essential to keep some definite system of records. These should include not only histories of individual foxes but accurate and complete entries of business transactions, in order to ascertain definitely at stated periods the assets, liabilities, and net worth of the business, the cost of production, and the profits.

The caretaker should jot down in a notebook memoranda regarding foxes, matings, breeding, whelping, happenings on the ranch, buying and selling transactions, etc., and these entries should be transferred at frequent intervals to a permanent record, such as a card-index file, consisting of one card for each individual fox. Instead of a card index some ranchers use a large sheet of paper showing a diagram of the ranch, and indicate on it the foxes in each pen and the number of pups whelped. As a separate sheet is used for each year, in time this type of record becomes unwieldy.

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FIG. 45.—Live-fox exhibit. The chief value of a fox show is in its educational features—standards of excellence being thus publicly demonstrated.

The advantages of a card system are obvious. When selections are being made for mating the caretaker is not dependent upon his memory, but has at hand definite records concerning the ancestry of each individual, including the good and bad characteristics of the strain. The card-index system of fox records is compact, always up to date—cards for foxes no longer on the ranch being easily filed elsewhere, with reason shown—and there is ample space for a systematic history of each individual fox.

Various systems have been advocated for the identification of foxes in order to prevent errors in records and facts regarding individuals. Some breeders have used ear tags marked with different numbers, but these tear out easily and are lost. Tattooing the ear has given as satisfactory results as any, but no method free from defects has yet been devised. The most practical method is to number the pens (see figs. 17 and 41) and then fasten to the pen a metal tag bearing the number of the occupant. When the fox is transferred to another pen a corresponding change is made in the tag.

## FOX SHOWS.

The chief value of a fox exhibit or show (Fig. 45), whether State, national, or international, lies in the educational features which present standards of excellence to the fox ranchers and the public. The educational value depends largely upon two things: (1) The classification of the animals to be exhibited, and (2) the judgment of the officials who pass upon their merits. These two factors are entirely dependent upon each other in presenting the lessons which an exhibition should teach. To be successful, fox shows must have the support of the breeders individually and of their associations.

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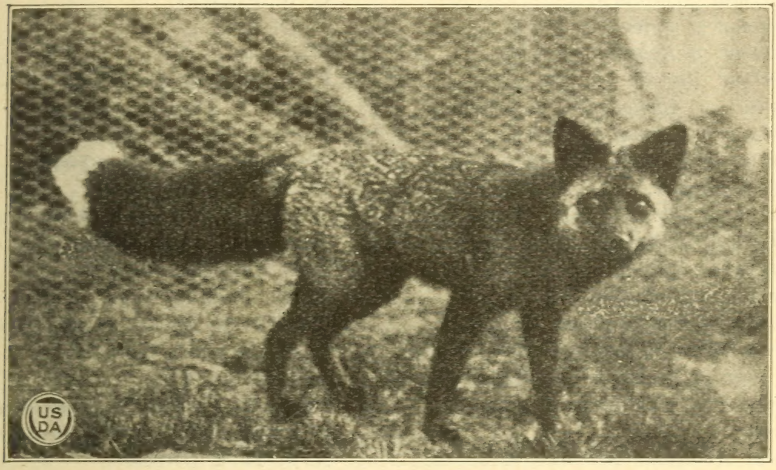


FIG. 46.—Well-formed male fox. Stands exceedingly well on legs and is well balanced with a beautiful brush.

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